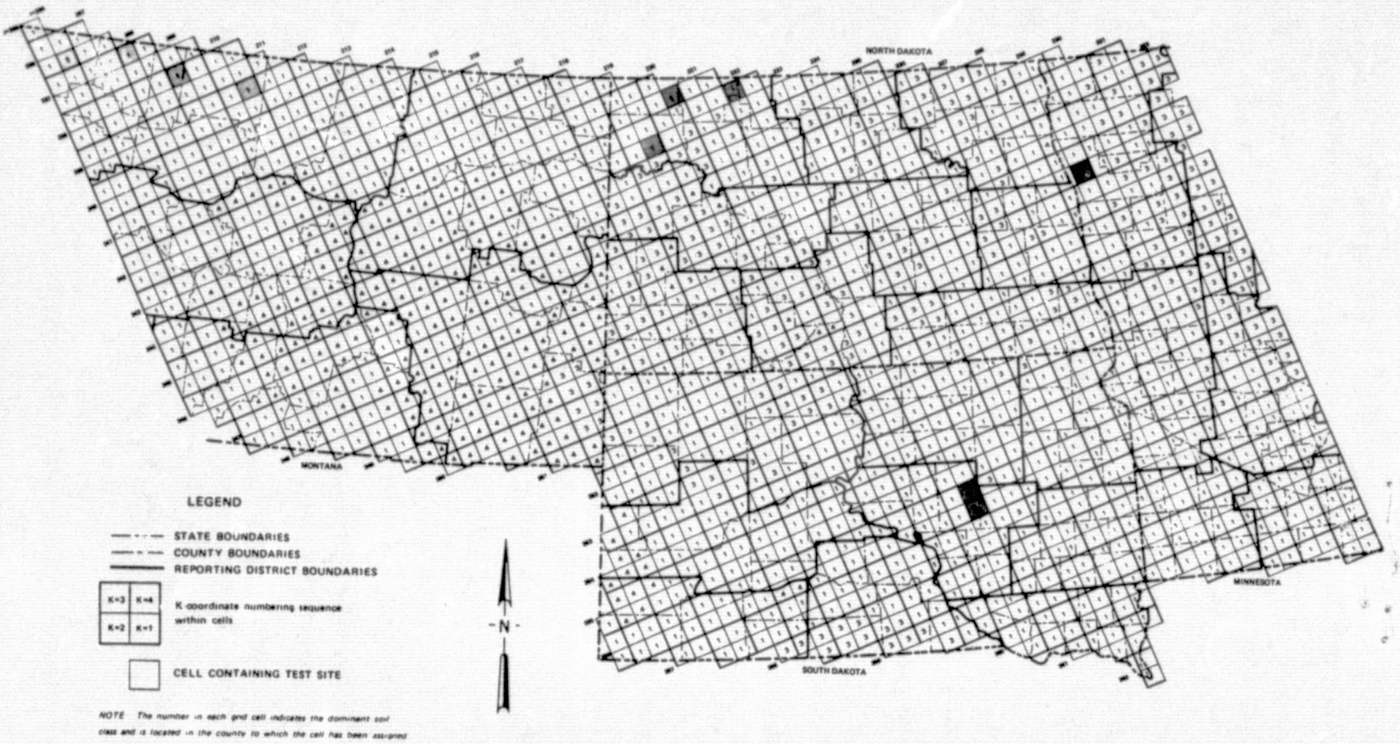
E/S NO. 1052

EARTHSAT SPRING WHEAT YIELD SYSTEM TEST 1975

FINAL REPORT
APPENDIX IV

NASA CR-147712



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APPENDIX IV

EARTHSAT AGMET SOFTWARE DOCUMENTATION

TABLE OF CONTENTS

1.0 OVERVIEW

This section provides a background for the EarthSat Spring Wheat Yield System and its documentation. Discussions are presented on (a) system purpose, (b) machine dependence, (c) system organization, and (d) documentation organization.

Section 1.1, "System Purpose" briefly provides a framework for the software discussion. Section 1.2 discusses machine-specific features of the AGMET system. Section 1.3 outlines the structure implemented in the 1975 test. Section 1.4 diagrams the remaining documentation and serves as a guide to its effective use.

1.1 System Overview

The EarthSat System operates on a global rectangular two-level cell structure, limited in the 1975 test to upper Great Plains spring wheat states; the system processes meteorological data from both ground observations and meteorologic satellites to define the plant weather aspects on a four time per day basis and calculates plant growth stages and defines soil moisture profiles, assesses plant stress and prepares forecasts of end-of-year yields on a cell by cell basis (12.5 x 12.5 n.m.).

The system is activated after entry, on a cell by cell basis, of soil characteristics, i.e., texture-related crop available moisture characteristics, starting soil moisture information, planting dates, etc.

The processing activities in the system are initiated by the entry of the meteorological data. Surface fitting routines and diagnostic models transform the input data into daily estimates of precipitation

(PRECIP) and potential evapotranspiration (ETP) on a 25 n.m, I,J grid. Once the atmospheric environmental factors have been defined, model assessments of daily soil moisture profiles and plant stress are prepared at the 12.5 x 12.5 n.m. (k) cell grid level.

Yield forecasts are prepared from a daily average stress from planting to ripe and the historical technological yield value. The yield forecasts are prepared at the cell level and then aggregated upward weighted on the basis of historical harvested acreage at the county, CRD and state levels.

All data calculated during the crop year are accumulated into a crop season master file for subsequent research and study availability. Specific site data are reformatted into time sequential files for ease in subsequent review and display.

1.2 Machine-specific Features

The EarthSat System was designed for and implemented on the IBM system 360/model 50 computer. Table 1-1 lists the system features required to support the system.

IBM Compatible Comparable With

1) IBM STANDARD system 360 utilities
2) STANDARD sort-merge facilities
3) STANDARD system catalogues
4) STANDARD link editor and loader
5) STANDARD MACRO library
6) FORTRAN G compiler
7) ASSEMBLER F assembler
8) STANDARD procedures (FORTGCLG, ASMFCL)

System Considerations for EarthSat Spring Wheat Yield System
Generation and Execution

TABLE 1-1

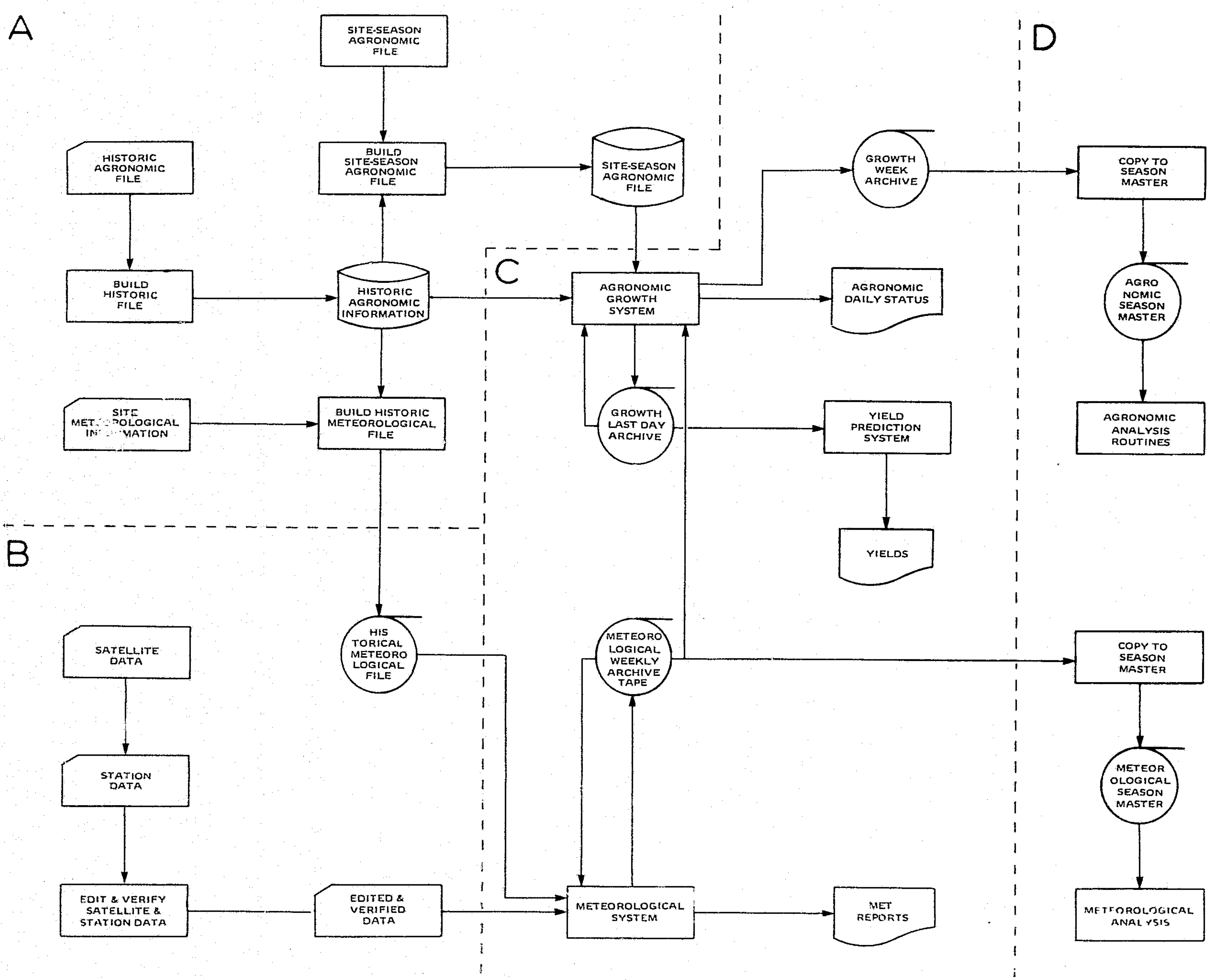
1.3 System Organization

The system organization is outlined in Figure 1.0. Task area A, performed once at the beginning of the growing season, generates the necessary background data files for the present season. Task areas B, C, and D are ongoing activities throughout the crop season. Task area B is a continuous activity required for extraction and interpretation of meteorological input data. This subsystem is an interactive, digitally assisted manual verification of satellite data and station reports. This manual-digital interaction assists detection and correction of errors and preparation of the final data deck structure. Task area C, the functional center of the EarthSat AGMET system is the agrometeorological-predictive subsystem. This subsystem processes raw meteorological data, grows the plant in its local environment, produces daily ground status reports, and periodically predicts yield for the various geographic regions. Task area D is a reoccurring task of collecting and storing the outputs of each cycle from the agronomic and meteorologic models. These provide ready inputs to post season analytical routines.

1.4 Documentation Organization

The documentation sections contain segment logical flow diagrams, if applicable, which relates the program components necessary to accomplish a given task. Each task in a segment logical flow diagram requires one or more programs. Documentation of each program in sections 3.0 to 6.0 includes:

FIGURE 1.0



A
B
C
D
SITE-SEASON AGRONOMIC FILE
HISTORIC AGRONOMIC FILE
BUILD SITE-SEASON AGRONOMIC FILE
SITE-SEASON AGRONOMIC FILE
GROWTH WEEK ARCHIVE
COPY TO SEASON MASTER
BUILD HISTORIC FILE
HISTORIC AGRONOMIC INFORMATION
AGRONOMIC GROWTH SYSTEM
AGRONOMIC DAILY STATUS
AGRO NOMIC SEASON MASTER
SITE
BUILD HISTORIC METEOROLOGICAL FILE
GROWTH LAST DAY ARCHIVE
YIELD PREDICTION SYSTEM
AGRONOMIC ANALYSIS ROUTINES
YIELDS
SATELLITE DATA
HIS TORICAL METEORO LOGICAL FILE
METEORO LOGICAL WEEKLY ARCHIVE TAPE
COPY TO SEASON MASTER
STATION DATA
METEOR OLOGICAL SEASON MASTER
EDIT & VERIFY SATELLITE & STATION DATA
EDITED & VERIFIED DATA
METEOROLOGICAL SYSTEM
MET REPORTS
METEOROLOGICAL ANALYSIS

1. Functional description.
2. Mathematical description.
3. Job Control Language.
4 Data Formats.
5. Program Flowcharts.
6. Source Code.
7. Sample Output.

In addition to the routine documentations, two special subsections are required, sections 2 and 7. Section 2 documents necessary pre-system activities and section 7 defines data base structure and record formats.

2.0 PRESYSTEM ACTIVITIES

Two types of general software require special handling to facilitate overall system flexibility and to reduce the complexities of using the system modules. These two items are conditional assembly MACROs and the general assembler subroutines supplied by EarthSat.

This section supplies the normal documentation of the software and the job control language to allocate and create the files containing the MACRO source and the executable asembler sub-programs.

All following sections containing executable modules assume generation of the Assembler subroutine library, and MACRO file. Requests for these modules are automatically resolved by the appropriate job control language.

2.1 MACRO

2.1.1 SETUP

2.1.1.1 Functional Description

SETUP is the EarthSat assembler MACRO which performs the following functions for the assembler programer:

1. Establishes a save area
2. Stores the calling program registers
3. Stores the return address
4. Stores the new save area address at the appropriate location in the calling routine
5. Establishes addressability

2.1.1.2 MATHEMATICAL DESCRIPTION

- none -

2.1.1.3 SETUP LOAD

Job Control Language

```
//SUPLOAD   JOB  (BR9001,746),ANDERSON,CLASS=F
//   EXEC  PGM=IEBGENER,REGION=80K
//*  DEFINE MACRO LIBRARY AND ENTER MEMBER SETUP
//*
//SYSPRINT DD SYSOUT=A
//SYSUTI DD *
```

- Source Deck -

```
//SYSUT2 DD DSN=EARTHSAT.MACLIB,DISP=(NEW,CATLG),
// UNIT=2314,VOL=SER=SCRT02,SPACE=(CYL,(1,1,20)),
//  DCB=(RECFM=FB,LRECL=80,BLKSIZE=1600,DSORG=PO)
//SYSIN DD *
 GENERATE MAXNAME=1
 MEMBER NAME=SETUP
/*
//
```

Data Description

SYSUT1 - Defines input source deck for IEBGENER

SYSUT2 - Defines output file

SYSIN - IEBGENER control statements refer IBM system, utilities manual for purpose and description

2.1.1.4 DATA DESCRIPTION

- none -

2.1.1.5 SOURCE CODE

```
         MACRO
&NAME    SETUP   &PAR
         LCLA    &NPAR,&DISP,&NBREG,&BREG
         LCLA    &LOC,&BREG1,&BREG2,&INC
         LCLA    &I,&K,&L,&TL
         LCLC    &BR(5)
&NPAR    SETA    N'&SYSLIST
&I       SETA    1
.SETREG  ANOP
&K       SETA    &K+1
&L       SETA    K'&SYSLIST(&K)
&TL      SETA    &TL+&L
         AIF     (&TL GT 8).SPANREG
&BR(&I)  SETC    '&BR(&I).&SYSLIST(&K)'
.COMMA   AIF     (&K EQ &NPAR).SAVE
&TL      SETA    &TL+1
         AIF     (&TL GT 8).SPANCOM
&BR(&I)  SETC    '&BR(&I).,'
         AGO     .SETREG
.SPANCOM ANOP
&I       SETA    &I+1
&TL      SETA    1
&BR(&I)  SETC    ','
         AGO     .SETREG
.SPANREG ANOP
         AIF     (&L+8 EQ &TL).NOSPAN
&BR(&I)  SETC    '&BR(&I).&SYSLIST(&K)'(1,8)
&I       SETA    &I+1
&BR(&I)  SETC    '&SYSLIST(&K)'(2,1)
&TL      SETA    1
         AGO     .COMMA
.NOSPAN  ANOP
&I       SETA    &I+1
&BR(&I)  SETC    '&SYSLIST(&K)'
&TL      SETA    &L
         AGO     .COMMA
.SAVE    ANOP
         DS      0F
&NAME    STM     14,12,12(13)
         BALR    15,0
         ST      13,18(0,15)
         MVC     8(4,13),86(15)
&DISP    SETA    86+&NPAR*4
&NBREG   SETA    1
&BREG    SETA    &SYSLIST(1)
         BAL     &BREG.,&DISP.(0,15)
         USING   *,&BR(1).&BR(2).&BR(3).&BR(4).&BR(5)
         DS      18F
         DC      A(*-72)
&LOC     SETA    4020
```

```
.GENADDR AIF      (&NBREG GE &NPAR).REG13
&NBREG   SETA     &NBREG+1
         DC       A(*+&LOC)
&LOC     SETA     &LOC+4092
         AGO      .GENADDR
.REG13   AIF      (&BREG EQ 13).LDADDR
         LR       13,&BREG
.LDADDR  ANOP
&DISP    SETA     72
&NBREG   SETA     1
.CKREG1  AIF      (&NBREG EQ &NPAR).MEND
&NBREG   SETA     &NBREG+1
&BREG1   SETA     &SYSLIST(&NBREG)
&DISP    SETA     &DISP+&INC*4+4
&INC     SETA     0
.CKREG2  ANOP
&INC     SETA     &INC+1
         AIF      (&NBREG EQ &NPAR).LDREG
&NBREG   SETA     &NBREG+1
&BREG2   SETA     &SYSLIST(&NBREG)
         AIF      (&BREG1+&INC EQ &BREG2).CKREG2
&NBREG   SETA     &NBREG-1
&BREG2   SETA     &SYSLIST(&NBREG)
.LDREG   AIF      (&INC GT 1).LDMREG
         L        &BREG1.,&DISP.(0,13)
         AGO      .CKREG1
.LDMREG  ANOP
         LM       &BREG1.,&BREG2.,&DISP.(0,13)
         AGO      .CKREG1
.MEND    ANOP
         MEND
```

2.2 General Assembler Subroutines

Assembler subroutines are used for strategic purposes to increase overall system efficiency. The following subroutines listed by CSECT name, with the stated purpose, are documented in this section:

1. AGIN: Supplies one file of binary read capability for the blocked records.
2. AGOUT: Supplies two files of binary write capability for blocked records.
3. BDAM: Supplies one file binary read-write capability for random access fixed records.
4. RWA: When called unconditionally ends program execution and provides a system core dump.

Subsequent reference to these subprograms assume the requirements of this section have been completed.

2.2.1 AGIN

2.2.1.1 FUNCTIONAL DESCRIPTION

This CSECT provides one file binary read capability for files with fixed or fixed blocked records. The CSECT AGIN contains two entry points: OPENAG which opens the input file on FT29F001; and AGREAD which reads a single record for each call into the buffer address specified in the call. It is the programmer's responsibility to insure space and structure for the data record buffer with an array or common block declaration containing the necessary space and structure.

2.2.1.2 MATHEMATICAL DESCRIPTION

- none -

2.2.1.3 PROGRAM LOAD

Job Control Language

```
//AGINLOAD  JOB  (BR9001,746),ANDERSON,CLASS=F
//STEP3 EXEC ASMFCL,PARM.ASM='LOAD,NODECK',PARM.LKED='LET,XREF'
//*
//*    LOAD SUBROUTINE AGIN
//*
//ASM.SYSLIB DD
//           DD DSN=EARTHSAT.MACLIB,DISP=SHR
//ASM.SYSIN  DD *
```

- Source Code -

```
//LKED.SYSLMOD DD DSN=EARTHSAT.LOADLIB,DISP=(NEW,CATLG),
// SPACE=(CYL,(10,2,20)),UNIT=2314,VOL=SER=IPIWRK,DCB=(RECFM=U,BLKSIZE=7294)
//LKED.SYSIN DD *
 ALIAS OPENAG,AGREAD
 NAME AGIN(R)
/*
//
```

Data Definition Description

ASM STEP

SYSLIB - Points to library for macro SETUP

LKED STEP

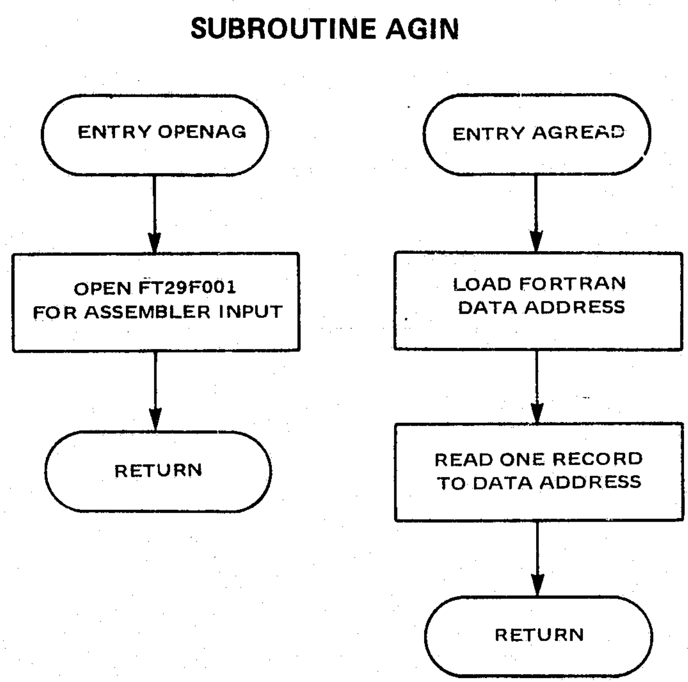
SYSLMOD - Library which will contain load module entry points in CSECT AGIN

SYSIN - Link editor control statements for description refer to IBM link editor loader manual.

2.2.1.4 DATA DESCRIPTION

- none -

2.2.1.5 FLOWCHART



2.2.1.6 SOURCE CODE

```
         PRINT NOGEN
         ENTRY OPENAG,AGREAD
AGIN     CSECT
OPENAG   SETUP 13
         OPEN  INPUT
         L     13,4(0,13)
         RETURN (14,12),RC=0
AGREAD   SETUP 13
         L     3,0(0,1)
         GET   INPUT,(3)
         L     13,4(0,13)
         RETURN (14,12),RC=0
DONE     CLOSE INPUT
         L     13,4(0,13)
         RETURN (14,12),RC=0
INPUT    DCB   DSORG=PS,MACRF=(GM),DDNAME=FT29F001,EODAD=DONE
         END
```

2.2.2 AGOUT

2.2.2.1 FUNCTIONAL DESCRIPTION

This CSECT provides two file binary write capability for files with fixed or fixed blocked records. The CSECT AGOUT contains three entry points: AGOPEN which opens both output files, FT31F001 and FT32F001; ERRWRT which writes a single record from a user buffer for each call to FT31F001; METWRT which writes a single record from a user buffer for each call to FT32F001.

2.2.2.2 MATH DESCRIPTION

- none -

2.2.2.3 PROGRAM LOAD

<u>Job Control Language</u>

```
//AGOTLOAD JOB (BR9001,746),ANDERSON,CLASS=F
//STEP4  EXEC ASMFCL,PARM.ASM='LOAD,NODECK',PARM.LKED='LET,XREF'
//*
//*     LOAD SUBROUTINE AGOUT
//*
//ASM.SYSLIB DD
//           DD DSN=EARTHSAT.MACLIB,DISP=SHR
//ASM.SYSIN DD *
```

- Source Code -

```
//LKED.SYSLMOD DD DSN=EARTHSAT.LOADLIB,DISP=SHR,
// SPACE=(CYL,(10,2,20))
//LKED.SYSIN DD *
 ALIAS AGOPEN,ERRWRT,METWRT,AGCLSE
 NAME AGOUT(R)
/*
//
```

<u>Data Definition Description</u>

<u>ASM STEP</u>
SYSLIB - EarthSat Macro location

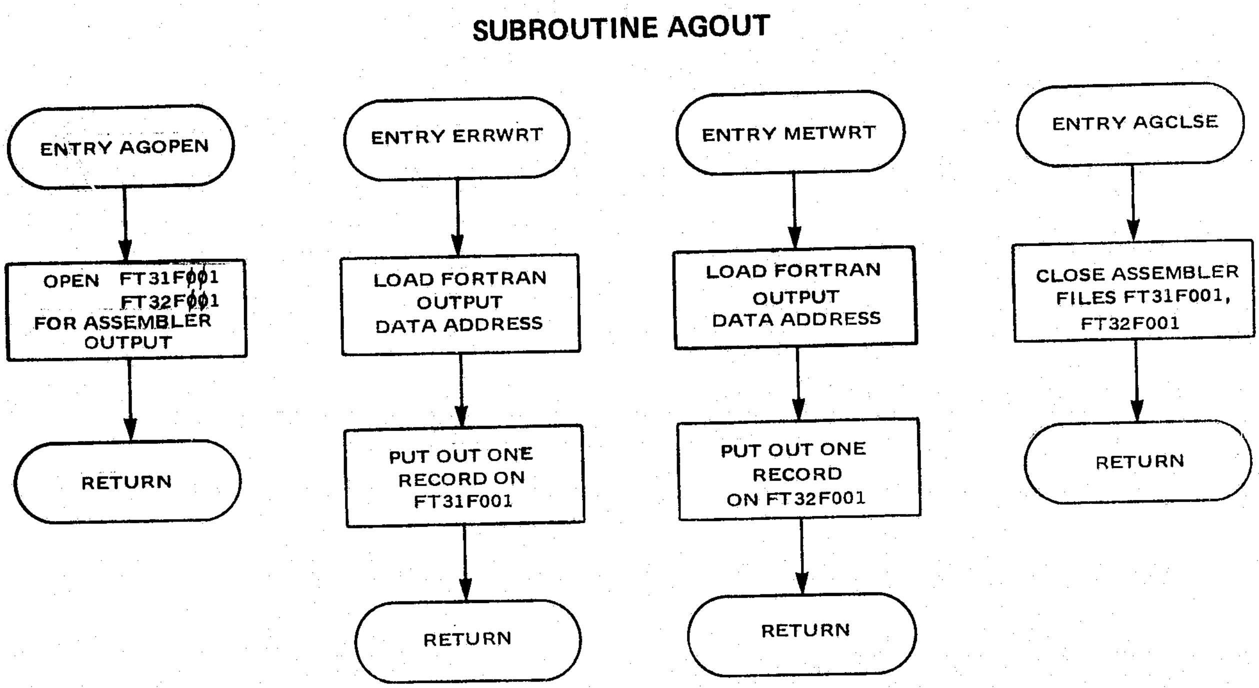
<u>LKED STEP</u>
SYSLMOD - Subroutine load module location

SYSIN - Link editor control statements refer to IBM link editor and loader manual.

2.2.2.4 DATA DESCRIPTION

- none -

2.2.2.5 FLOWCHART



2.2.2.6 SOURCE CODE

```
         PRINT NOGEN
     ENTRY AGOPEN,ERRWRT,METWRT,AGCLSE
AGOUT       CSECT
AGOPEN       SETUP 13
             OPEN (OUTPUT,(OUTPUT),OUTPU2,(OUTPUT))
             L 13,4(0,13)
             RETURN (14,12),RC=0
ERRWRT       SETUP 13
             L 3,0(0,1)
             PUT OUTPUT,(3)
             L 13,4(0,13)
             RETURN (14,12),RC=0
METWRT       SETUP 13
             L 3,0(0,1)
             PUT OUTPU2,(3)
             L 13,4(0,13)
             RETURN (14,12),RC=0
AGCLSE       SETUP 13
             CLOSE OUTPU2
             CLOSE OUTPUT
             L 13,4(0,13)
             RETURN (14,12),RC=0
OUTPUT       DCB DSORG=PS,MACRF=(PM),DDNAME=FT31F001
OUTPU2       DCB DSORG=PS,MACRF=(PM),DDNAME=FT32F001
             END
```

2.2.3 BDAM SUBROUTINE

2.2.3.1 FUNCTIONAL DESCRIPTION

The CSECT UPDATE contains four entry points: HSTOPN which opens the input, ouput file HISTORIC and defines the buffer location; HSTCLS which closes the HISTORIC file; HSTRD which reads the Ith record from HISTORIC where I is user supplied; HSTWRT which writes the Ith record to HISTORIC where I is user supplied.

2.2.3.2 MATH DESCRIPTION

- none -

2.2.3.3 PROGRAM LOAD

<u>Job Control Language</u>

```
//BDAM JOB (BR9001,746),ANDERSON,CLASS=F
//STEP5  EXEC ASMFCL,PARM.ASM='LOAD,NODECK',PARM.LKED='LET,XREF'
//*
//*      LOAD SUBROUTINE BDAM
//*
//ASM.SYSLIB DD
//             DD DSN=EARTHSAT.MACLIB,DISP=SHR
//ASM.SYSIN DD *
```

- Source Code -

```
//LKED.SYSLMOD DD DSN=EARTHSAT.LOADLIB,DISP=SHR,
// SPACE=(CYL,(10,2,20))
//LKED.SYSIN DD *
 ALIAS HSTOPN,HSTCLS,HSTRD,HSTWRT
 NAME UPDATE(R)
/*
//
```

<u>Data Definition Description</u>

<u>ASM STEP</u>

SYSLIB - Points to library for macro SETUP

<u>LKED STEP</u>

SYSLMOD - Library which will contain load module entry points in CSECT AGIN

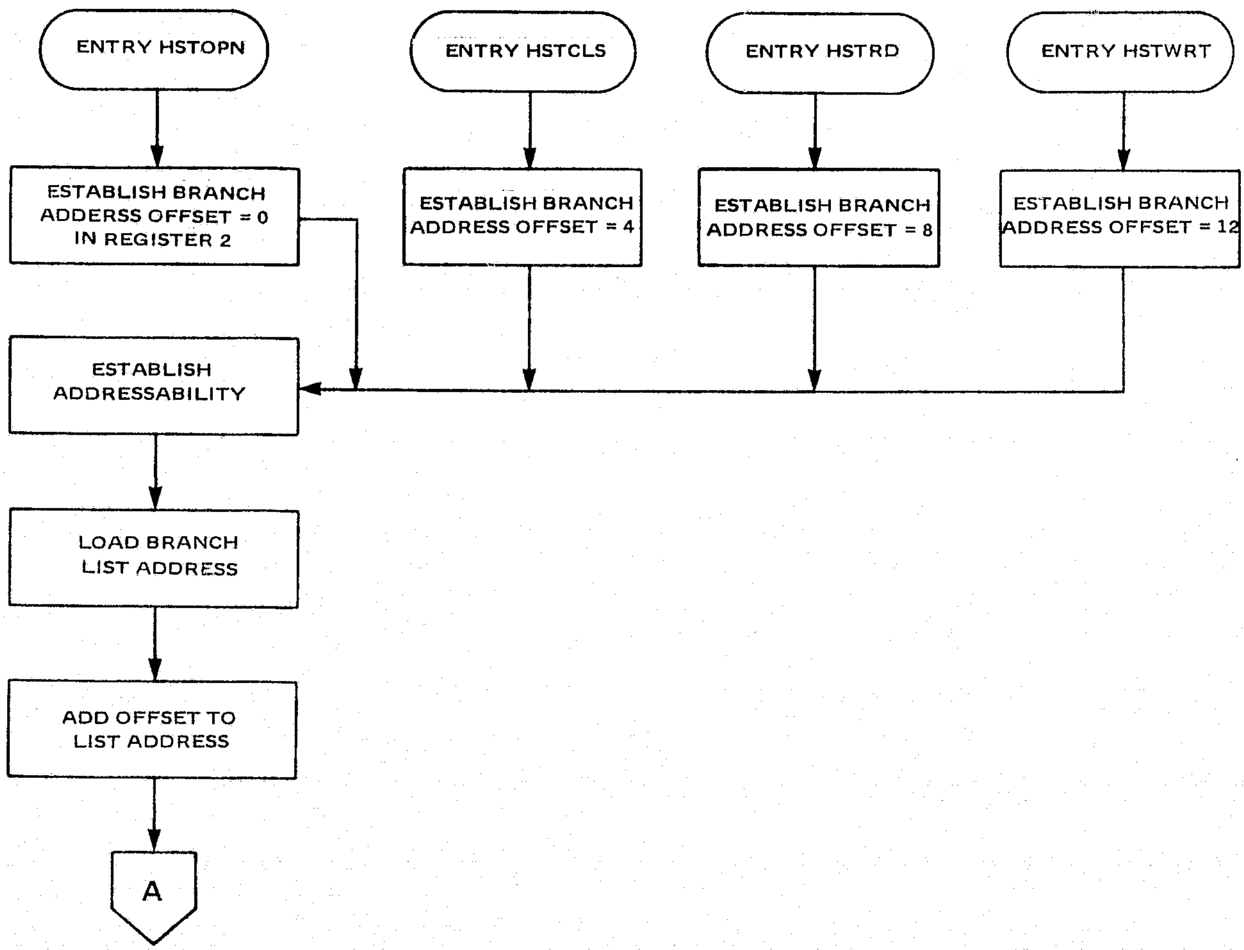
SYSIN - Link editor control statements refer to IBM link editor loader manual.

2.2.3.4 DATA DESCRIPTION

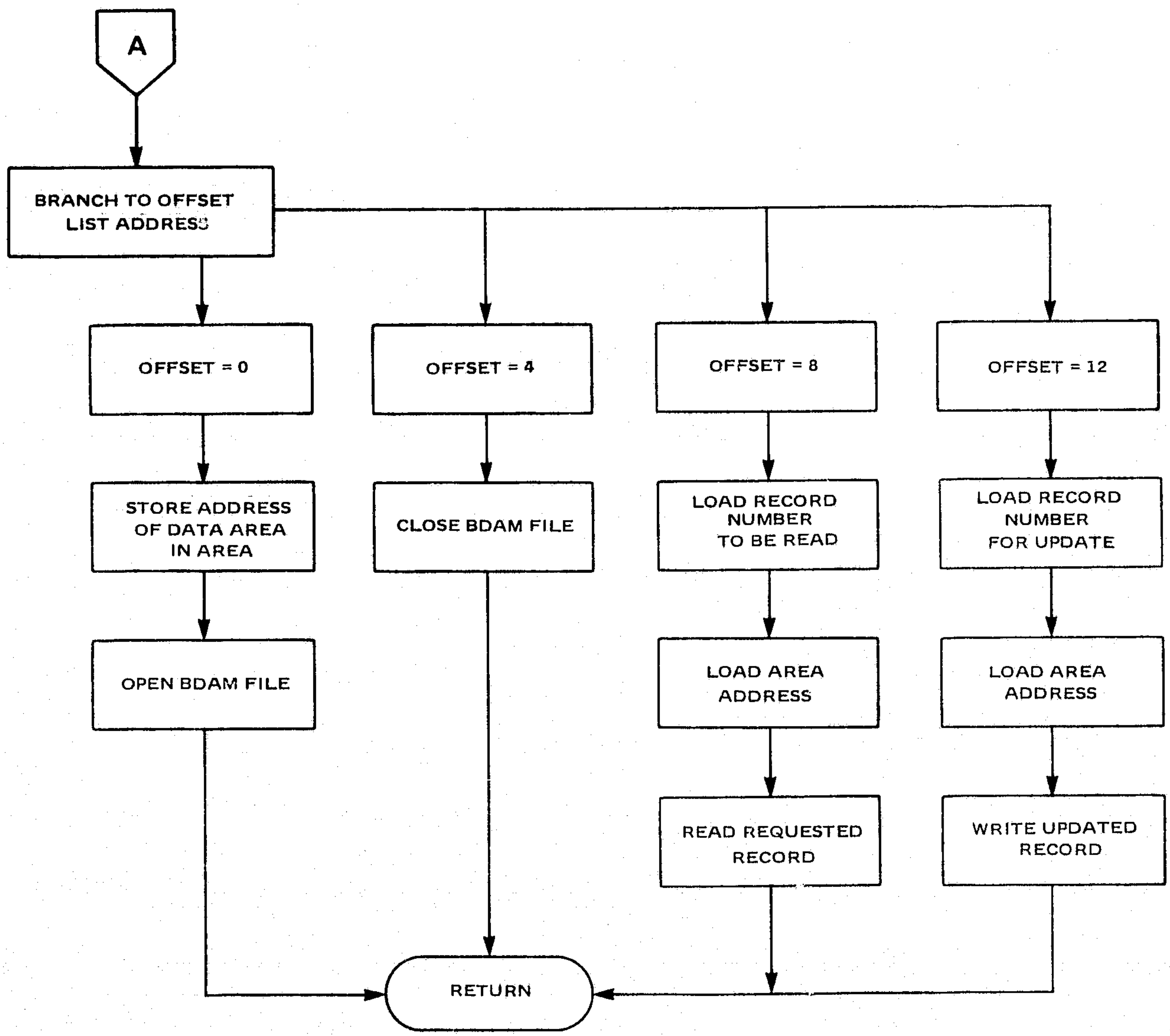
- none -

2.2.3.5 FLOWCHART

SUBROUTINE BDAM



SUBROUTINE BDAM



2.2.3.6 SOURCE CODE

```
UPDATE    CSECT
          ENTRY HSTOPN,HSTCLS,HSTRD,HSTWRT
HSTOPN    LA    2,0
          B     28(15)
HSTCLS    LA    2,4
          B     20(15)
HSTRD     LA    2,8
          B     12(15)
HSTWRT    LA    2,12
          SETUP 13
*
          LA    3,BRANCH
          L     3,0(2,3)
          BR    3
*
OPEN      L     2,0(1)
          ST    2,AREA
          OPEN  (HISTORIC,UPDAT)
          B     RETURN
*
CLOSE     CLOSE HISTORIC
          B     RETURN
*
READ      L     2,0(1)
          L     2,0(2)
          ST    2,POSITION
          L     3,AREA
          READ  DECBR,DI,HISTORIC,(3),'S',0,POSITION+1
          CHECK DECBR
          B     RETURN
*
WRITE     L     2,0(1)
          L     2,0(2)
          ST    2,POSITION
          L     3,AREA
          WRITE DECBW,DI,HISTORIC,(3),'S',0,POSITION+1
          CHECK DECBW
*
RETURN    L     13,4(13)
          RETURN (14,12),RC=0
*
AREA      DC    F'0'
POSITION  DC    F'0'
BRANCH    DC    A(OPEN,CLOSE,READ,WRITE)
*
HISTORIC  DCB   DSORG=DA,MACRF=(RIC,WIC),DDNAME=HISTORIC,OPTCD=R
          END
```

2.2.4 RWA SUBROUTINE

2.2.4.1 FUNCTIONAL DESCRIPTION

The CSECT RWA has one entry point: ABED which abends the program for dump with user 200 condition code. Useful in debugging under unusual conditions.

2.2.4.2 MATH DESCRIPTION

- none -

2.2.4.3 PROGRAM LOAD

```
//RWALOAD JOB (BR9001,746),ANDERSON,CLASS=F
//STEP6  EXEC ASMFCL,PARM.ASM='LOAD,NODECK',PARM.LKED='LET,XREF'
//*
//*     LOAD SUBROUTINE ABEND
//*
//ASM.SYSLIB DD
//            DD DSN=EARTHSAT.MACLIB,DISP=SHR
//ASM.SYSIN DD *
//LKED.SYSLMOD DD DSN=EARTHSAT.LOAD,DISP=SHR,
// SPACE=(CYL,(10,2,20))
//LKED.SYSIN DD *
 ALIAS ABED
 NAME RWA(R)
/*
//
```

<u>Data Definition Description</u>

<u>ASM STEP</u>

SYSLIB - Points to library for macro SETUP

<u>LKED STEP</u>

SYSLMOD - Library which will contain load module entry points in CSECT AGIN

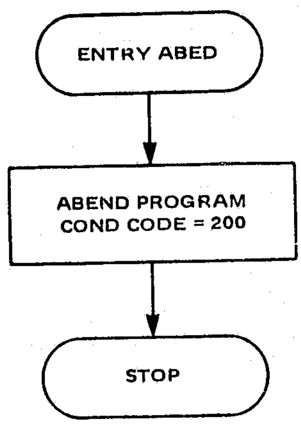
SYSIN - Link editor control statements refer to IBM link editor loader manual.

2.2.4.4 DATA DESCRIPTION

- none -

2.2.4.5 FLOWCHART

SUBROUTINE RWA



2.2.4.6 SOURCE CODE

```
         ENTRY ABED
RWA      CSECT
ABED     SETUP 13
         ABEND 200,DUMP,STEP
         L 13,4(0,13)
         RETURN (14,12),RC=0
         END
```

3.0 HISTORIC AND SITE SPECIFIC DATA FILE GENERATION

System requirements for site historical constants and seasonal initialization are met by generation of three data bases:

1) the agronomic-historic (Figure 3.1);
2) the meteorological-historic (Figure 3.2);
3) the season agronomic (Figure 3.3).

Each data base supplies specific information at the appropriate cell level required for system operation. The sequent diagrams, Figures 3.1, 3.2, 3.3 relate the data and the programs required to generate a specific file.

3.1 Agronomic-Historic File Generation

Construction of the agronomic-historic file used to model plant growth requires three programs:

1) HISTGEN which creates the record organization, calculates the latitude, longitude, of each i, j, k;
2) HISTADD which enters the state, county, crop reporting district, soil type assignment for each i, j, k;
3) HISTUP which enters the start BMT and planting date for each i, j, k.

The following information is contained in each record of this file:

1) i, j, k;
2) latitude, longitude of i, j, k;
3) state county, crop reporting district;
4) soil type indicator;
5) planting date.

HISTORIC AGRONOMIC FILE

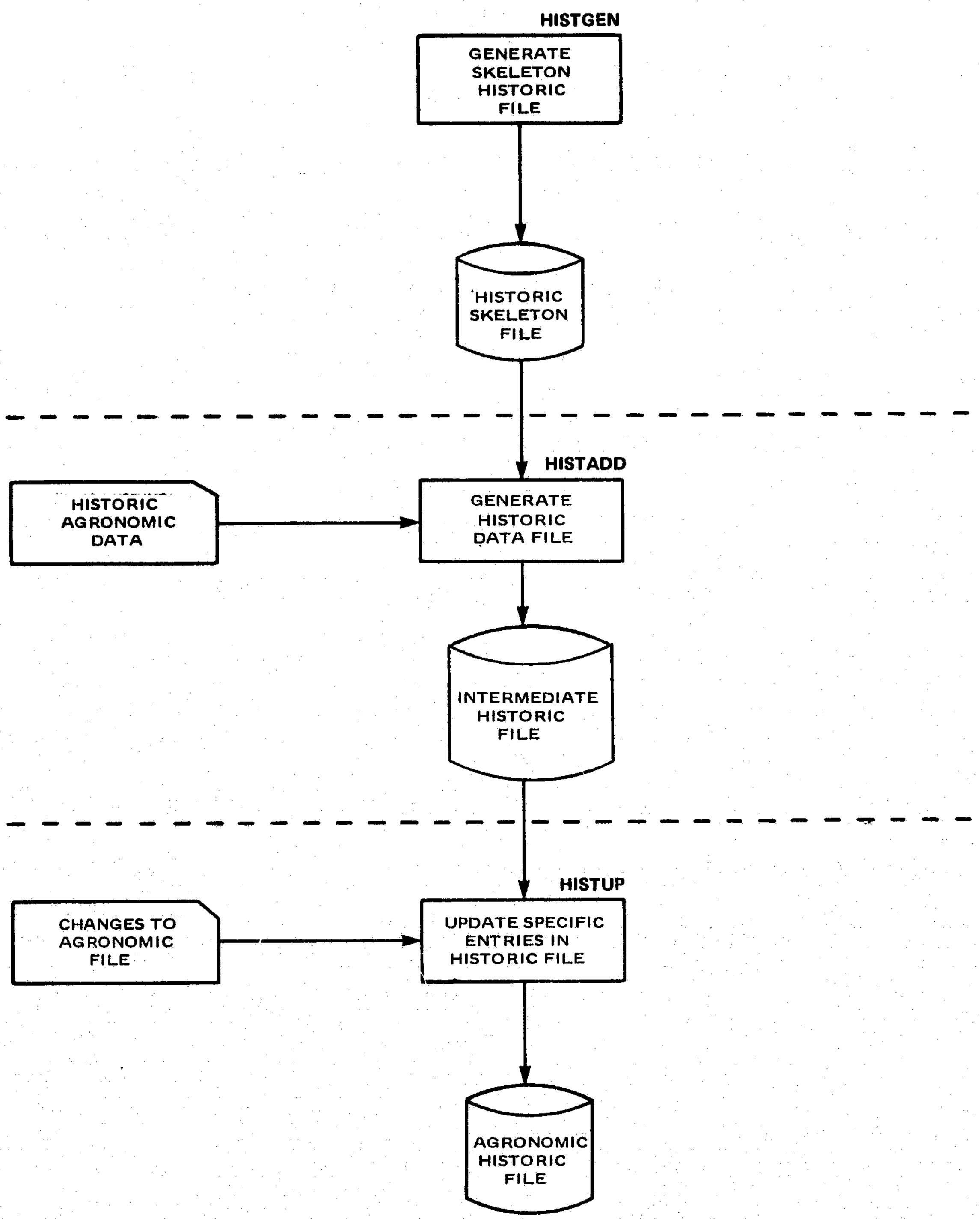


FIGURE 3.1

HISTORIC METEOROLOGICAL FILE

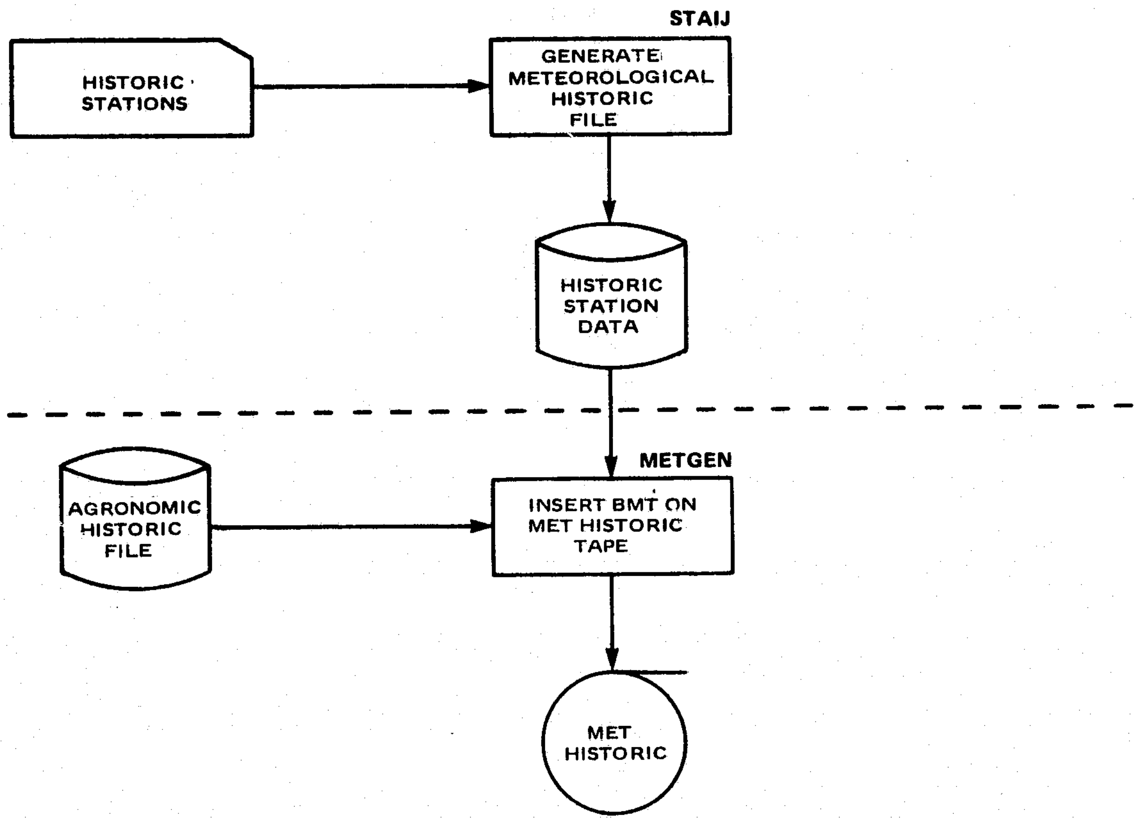


FIGURE 3.2

SITE SPECIFIC AGRONOMIC INFORMATION

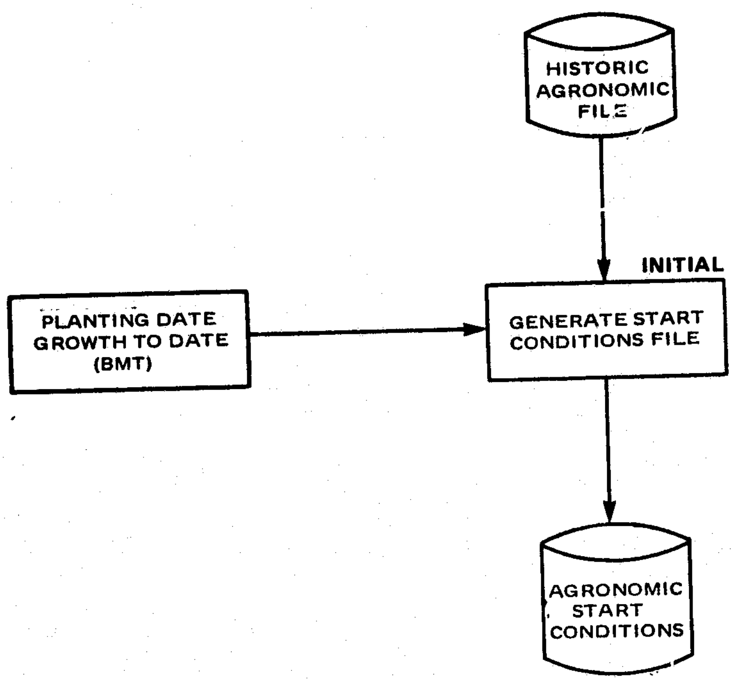


FIGURE 3.3

3.1.1 HISTGEN

3.1.1.1 Functional Description

The program HISTGEN performs two primary functions:

1) creates the record organization for the agronomic-historical file;

2) assigns grid i, j, k and associated latitude-longitudes to each output record.

Records are stored in ascending sequence according to i, j, k. The first record generated is a null record to allow random access of data records beginning with the key of 1.

3.1.1.2 Mathematical Description

Grid Mesh Structure: The grid mesh structure is rectangular to a polar stereographic projection of the northern hemisphere. The spacing between successive midpoints at mid-latitude is about 25 nautical miles. The j axis is parallel to the great circle defined by 100°E longitude and 80° W longitude. The North Pole is at (i=257, j=257). The equations relating latidude (lat) and longitude (lon) to ijk are:

$$i = 257 + r \cos a$$

$$j = 257 + r \sin a$$

where $r = 249.635 \tan ((90° - lat)/2)$

$a = 10 - lon$

longitude is defined as positive in the eastern hemisphere and negative in the western.

This grid mesh defines the points at which the meteorological input parameters are determined.

3.1.1.3 HISTGEN EXECUTION

Job Control Language

```
//HISTGEN JOB (BR9001,746),ANDERSON,CLASS=F
//     EXEC FORTGCLG,PARM.FORT='MAP,ID'
//FORT.SYSIN  DD *

                     -  Source Deck  -

//LKED.SYSLIB DD
//      DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.FT31F001 DD DSN=HISTS,DISP=(NEW,CATLG),VOL=SER=IPIWRK,
//   DCB=(RECFM=F,BLKSIZE=40),UNIT=2400-4
//GO.FT32F001 DD DUMMY,DCB=BLKSIZE=80
/*
//
```

Data Definition Description

LKED STEP

SYSLIB - Makes available additional general subroutines supplied by EarthSat

GO STEP

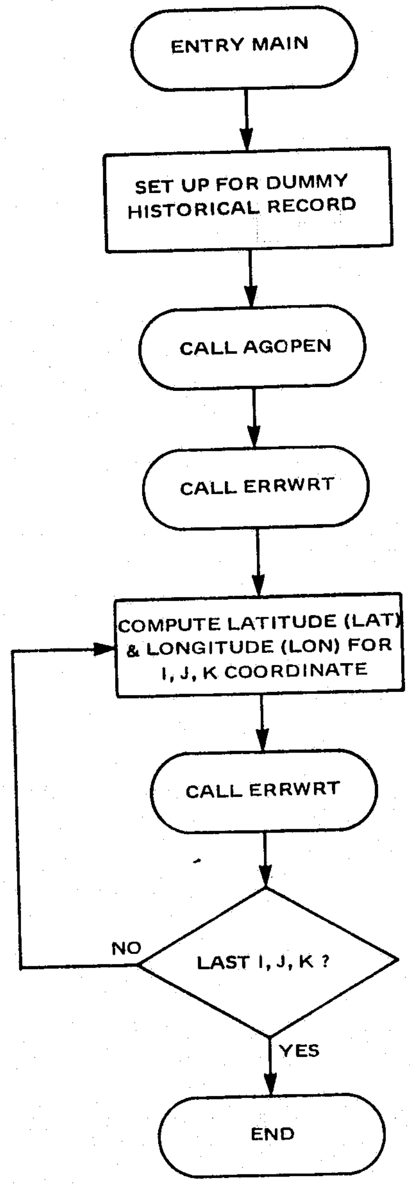
FT06F001 - No Data
FT06F001 - Printer file for FORTRAN error messages
FT31F001 - Intermediate agronomic historic file
FT32F001 - Unused output file

3.1.1.4 DATA DESCRIPTION

- none -

3.1.1.5 FLOWCHART

HISTGEN



3.1.1.6 SOURCE CODE

```
      INTEGER*2 STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      INTEGER*4 I,J
      REAL*4 ROW,COL,X,Y
      REAL*4 LAT,LON,YLDTRN,YLDADF,INC(2,4)
      COMMON/HIST/ L,M,K,LAT,LON,YLDTRN,YLDADF,STATE,
     XCOUNTY,CRD,SOIL,PLNDAT,TSTSIT
      DATA INC/0.5,0.5,-.5,0.5,-.5,-.5,0.5,-.5/
      CALL AGOPEN
      STATE=0
      COUNTY=0
      CRD=0
      SOIL=0
      PLNDAT=0
      TSTSIT=0
      YLDTRN=0.0
      L=0
      M=0
      I=0
      J=0
      K=0
      LAT=0.0
      LON=0.0
      YLDADF=0.0
      CALL ERRWRT(L)
C
C                             MAJOR LOOP
C
      DO 50 I=206,236
      L=I
      DO 50 J=335,362
      M=J
      DO 50 K=1,4
      COL=FLOAT(I)+INC(1,K)
      ROW=FLOAT(J)+INC(2,K)
      X=(257.-ROW)/(257.-COL)
      Y=ATAN(X)
      LON=-170.-57.2958*Y
      X=(ROW-257.)/(249.635*SIN(Y))
      LAT=90.+114.59156*ATAN(X)
      CALL ERRWRT(L)
 50   CONTINUE
      STOP
      END
```

3.1.2 HISTADD

3.1.2.1 Functional Description

The program HISTADD updates inplace the following items in the file generated by HISTGEN:

1) county location of i, j;
2) state location of i, j;
3) crop reporting district of i, j;
4) soil type of each i, j;
5) produces an updated historical file.

3.1.2.2 Mathematical Description

- None -

3.1.2.3 HISTADD EXECUTION

Job Control Language

```
//HISTADD JOB (BT9001,746),BELKNAP,CLASS=F
//S2 EXEC FORTGCLG,TIME.GO=5,REGION.GO=100K
//FORT.SYSIN DD *

                    -  Source Deck  -

//LKED.SYSLIB DD
//  DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.SYSIN DD *
Unit 5 Data Deck

//HISTORIC DD DSN=HISTS,DISP=(OLD,KEEP,KEEP)
/*
//
```

Data Definition Description

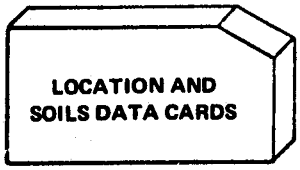
LKED STEP
- SYSLIB - Makes available additional general use subroutines supplied by EarthSat

GO STEP
- FT05F001 - Card data (Section 3.1.2.5)
- FT06F001 - Printer output (Section 3.1.2.7)
- HISTORIC - Intermediate agronomic historic file

3.1.2.4 DATA DESCRIPTION

FT05F001 INPUT CARD DATA

1. SEQUENCE



INDETERMINATE
NO. OF CARDS

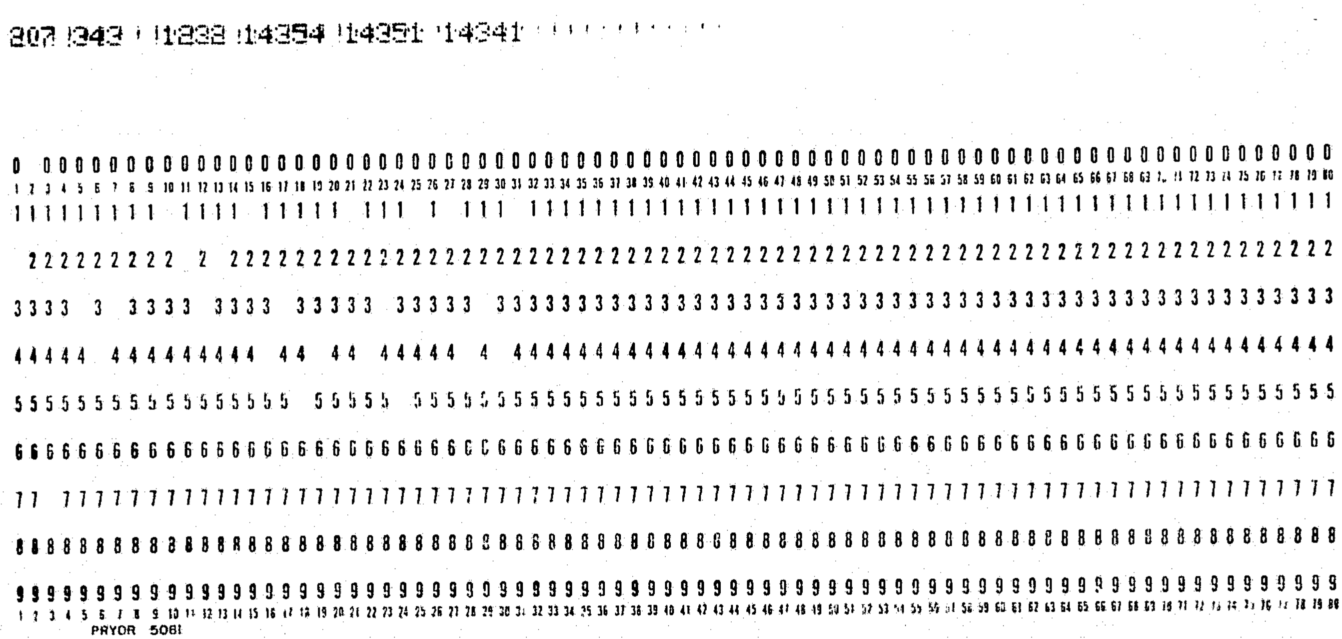
LOCATION AND
SOIL DATA CARD

LOCATION & SOILS DATA CARD

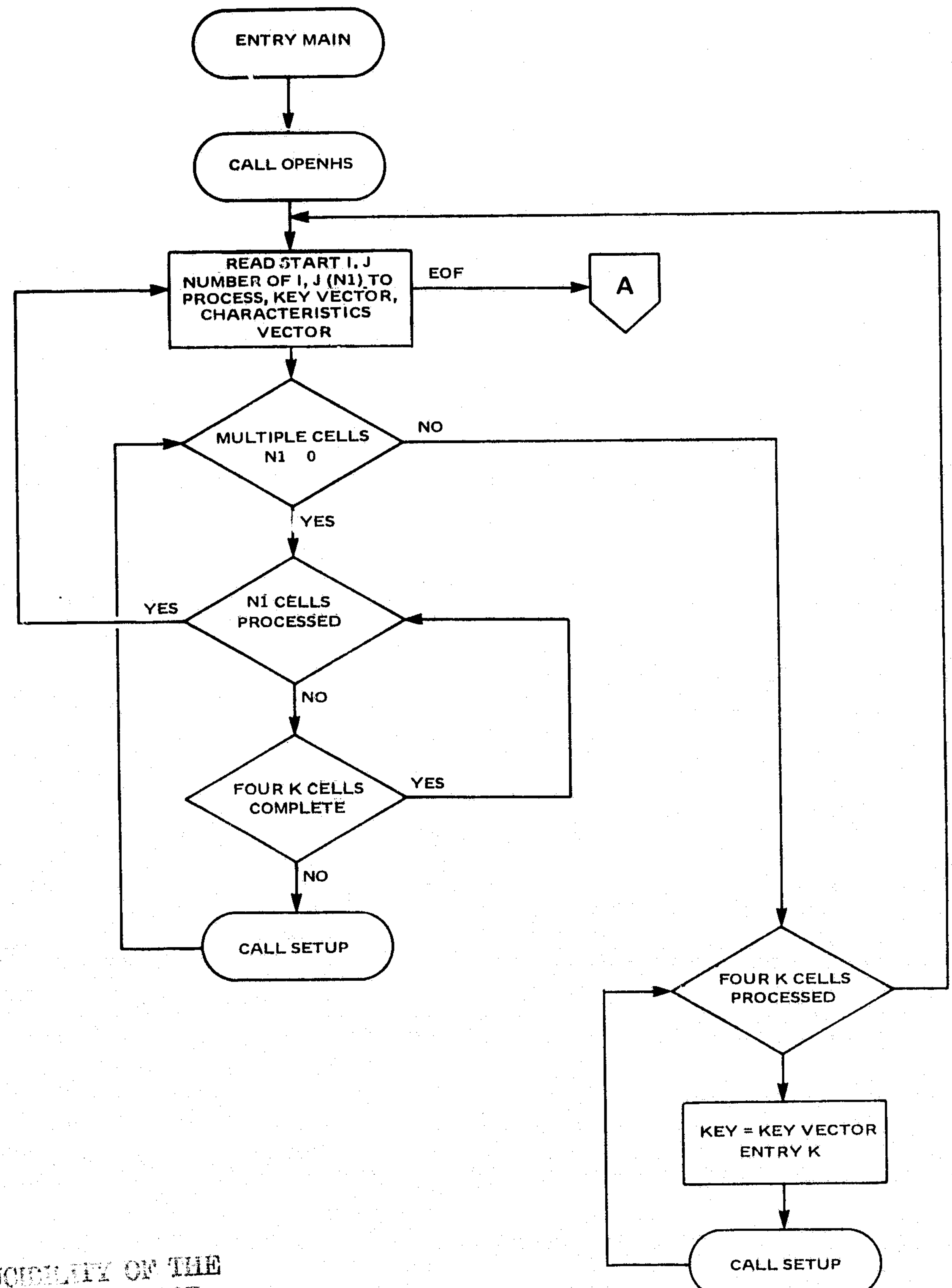
Format: (I3,I4,I2,4I1,4(1X,2I1,I2,I1)

Variable	Format	Cols	Description
I1	I3	1-3	I Location
J1	I4	3-6	J Location
N1	I2	7-8	multiple K cell assignment indicator
KG(N)	4I1	9-12	K cell assignment for cell N in KG if applicable
LGC1,1)	I1	14	State of I,J,K
LG(2,J)	I1	15	Crop Reporting district of I,J,K
LG(3,J)	J2	16-17	County of I,J,K
LG(4,J)	I1	18	Soil type of I,J,K
.			
.			
.			
LG(1,4)	I1	32	
.			
.			
.			
LG(4,4)	I1	36	

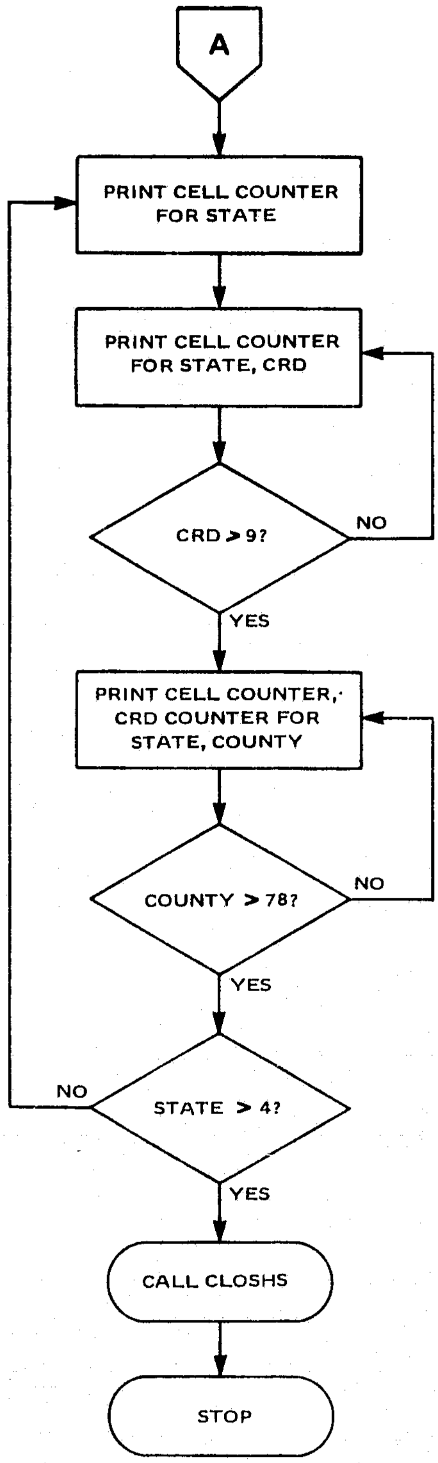
Sample Card:



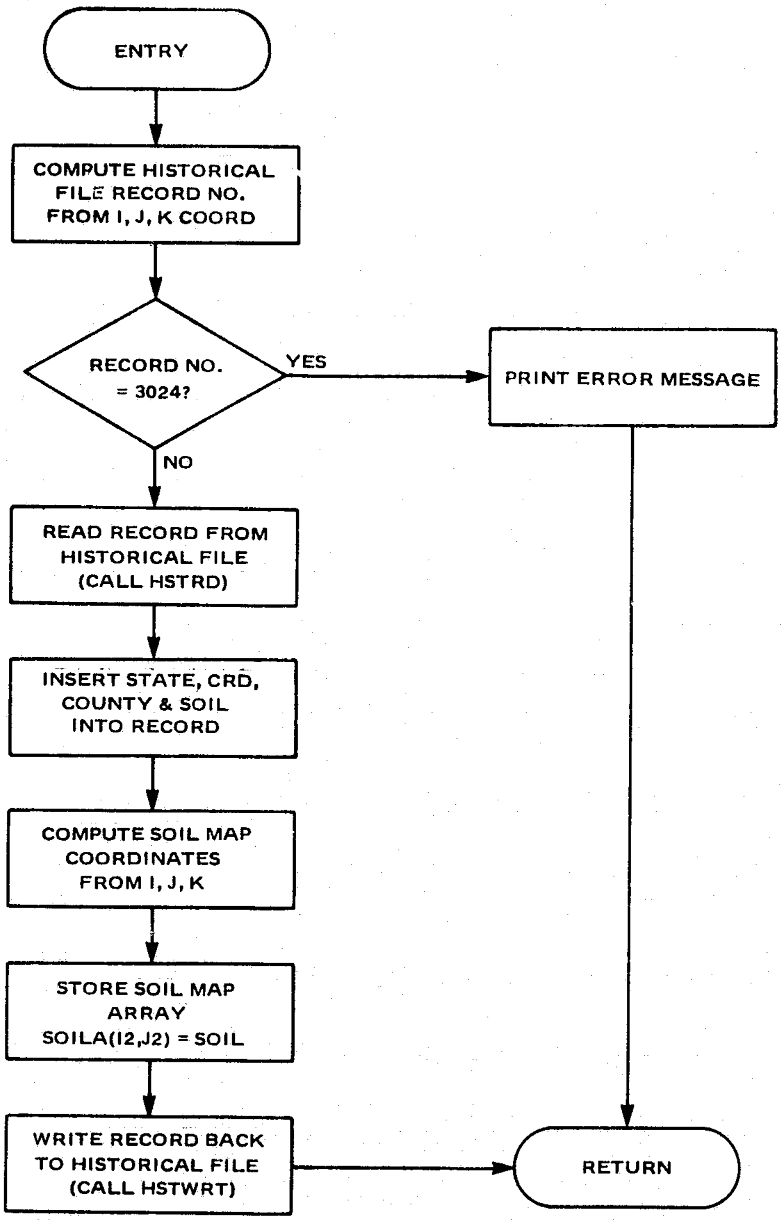
3.1.2.5 FLOWCHART HISTADD



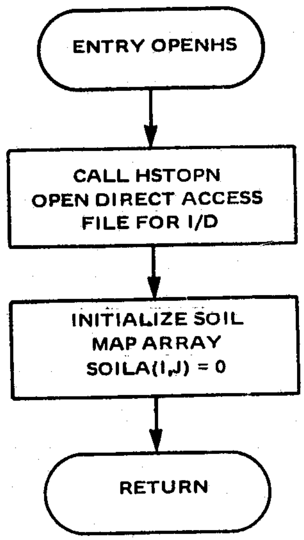
HISTADD

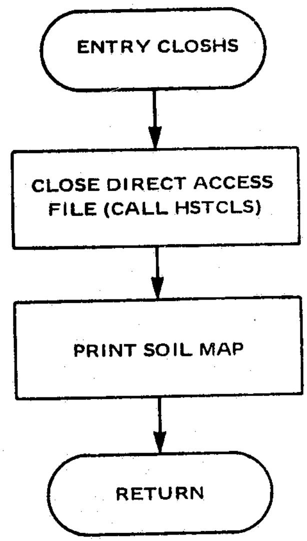

A
PRINT CELL COUNTER FOR STATE
PRINT CELL COUNTER FOR STATE, CRD
CRD > 9?
NO
YES
PRINT CELL COUNTER, CRD COUNTER FOR STATE, COUNTY
COUNTY > 78?
NO
YES
STATE > 4?
NO
YES
CALL CLOSHS
STOP

SUBROUTINE HISTUP

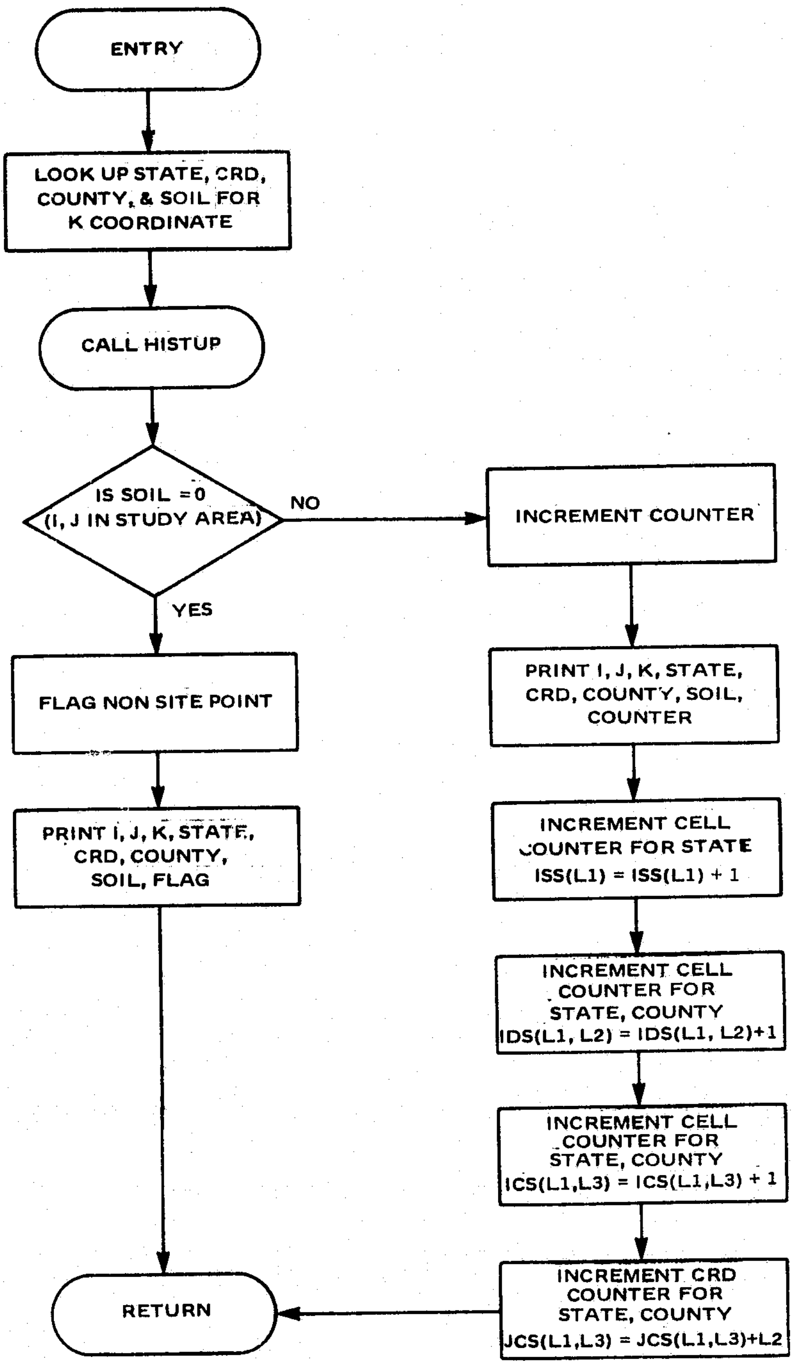


SUBROUTINE OPENHS





SUBROUTINE SETUP



3.1.2.6 SOURCE CODE

```
      INTEGER*4 KG(4)
      INTEGER*2 LG(4,4),ISS(4)/4*0/,IDS(4,9)/36*0/,ICS(4,78)/312*0/,
     *  JCS(4,78)/312*0/,I1,J1,K1,L1,L2,L3,L4
      CALL OPENHS
      N=0
      WRITE(6,999)
  999 FORMAT('1 I    J   K    STATE   CRD    CO.   SOIL'/)
    5 READ(5,1000,END=60) I1,J1,N1,KG,LG
 1000 FORMAT(I3,I4,I2,4I1,4(1X,2I1,I2,I1))
      IF(N1) 10,10,30
   10 DO 20 K=1,4
      K1=K
      K2=KG(K)
      CALL SETUP(K1,K2,LG,I1,J1,N,ISS,IDS,ICS,JCS)
   20 CONTINUE
      GO TO 5
   30 DO 50 KK=1,N1
      DO 40 K=1,4
      K1=K
      CALL SETUP(K1,1,LG,I1,J1,N,ISS,IDS,ICS,JCS)
   40 CONTINUE
      J1=J1+1
      IF(J1.GT.362) I1=I1+1
      IF(J1.GT.362) J1=335
   50 CONTINUE
      GO TO 5
   60 WRITE(6,2000)
 2000 FORMAT('1STATE  CRD  CO.   NO. CELLS'/)
      DO 90 I=1,4
      WRITE(6,3000) I,ISS(I)
 3000 FORMAT(1H0,I3,16X,I4)
      DO 70 J=1,9
   70 IF(IDS(I,J).GT.0) WRITE(6,4000) I,J,IDS(I,J)
 4000 FORMAT(1X,I3,5X,I1,10X,I4)
      DO 80 J=1,78
   80 IF(ICS(I,J).GT.0) WRITE(6,5000) I,J,ICS(I,J),JCS(I,J)
 5000 FORMAT(1X,I3,9X,I2,5X,I4,9X,I3)
   90 CONTINUE
      CALL CLOSHS
      STOP
      END
```

```
      SUBROUTINE SETUP(K1,K2,LG,I1,J1,N,ISS,IDS,ICS,JCS)
      INTEGER*2 LG(4,4),ISS(4),IDS(4,9),ICS(4,78),JCS(4,78),
     *  I1,J1,K1,L1,L2,L3,L4
      L1=LG(1,K2)
      L2=LG(2,K2)
      L3=LG(3,K2)
      L4=LG(4,K2)
    5 CALL HISTUP(I1,J1,K1,L1,L2,L3,L4)
      IF(L4.GT.0) N=N+1
      NP=N
      IF(L4.EQ.0) NP=11111
      WRITE(6,1000) I1,J1,K1,L1,L2,L3,L4,NP
 1000 FORMAT(1X,2I4,I2,4I6,10X,I4)
      IF(L4) 20,20,10
   10 ISS(L1)=ISS(L1)+1
      IDS(L1,L2)=IDS(L1,L2)+1
      ICS(L1,L3)=ICS(L1,L3)+1
      JCS(L1,L3)=JCS(L1,L3)+L2
   20 RETURN
      END
```

```
      SUBROUTINE HISTUP(I,J,K,S,CR,CN,SL)
      INTEGER*2 I,J,K,S,CR,CN,SL,STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      REAL LAT,LON
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,
     X CRD,SOIL,PLNDAT,TSTSIT
      INTEGER*2 COLINC(4)/1,0,0,1/,ROWINC(4)/1,1,0,0/
      INTEGER*2 SOILA(54,56)
      COMMON/SLAR/SOILA
      I1=I-205
      J1=J-334
      K1=K
      N=112*(I1-1)+4*(J1-1)+K
      IF(N.LT.1.OR.N.GT.3024) GO TO 10
      CALL HSTRD(N)
      STATE=S
      CRD=CR
      COUNTY=CN
      SOIL=SL
      I2=(2*(I1-1))+1+COLINC(K1)
      J2=(2*(J1-1))+1+ROWINC(K1)
      SOILA(I2,J2)=SOIL
      CALL HSTWRT(N)
      RETURN
10    WRITE(6,2000) I,J,K,N
2000  FORMAT(//,10X,'RECORD # ERROR ',4I4,//)
      RETURN
      END
```

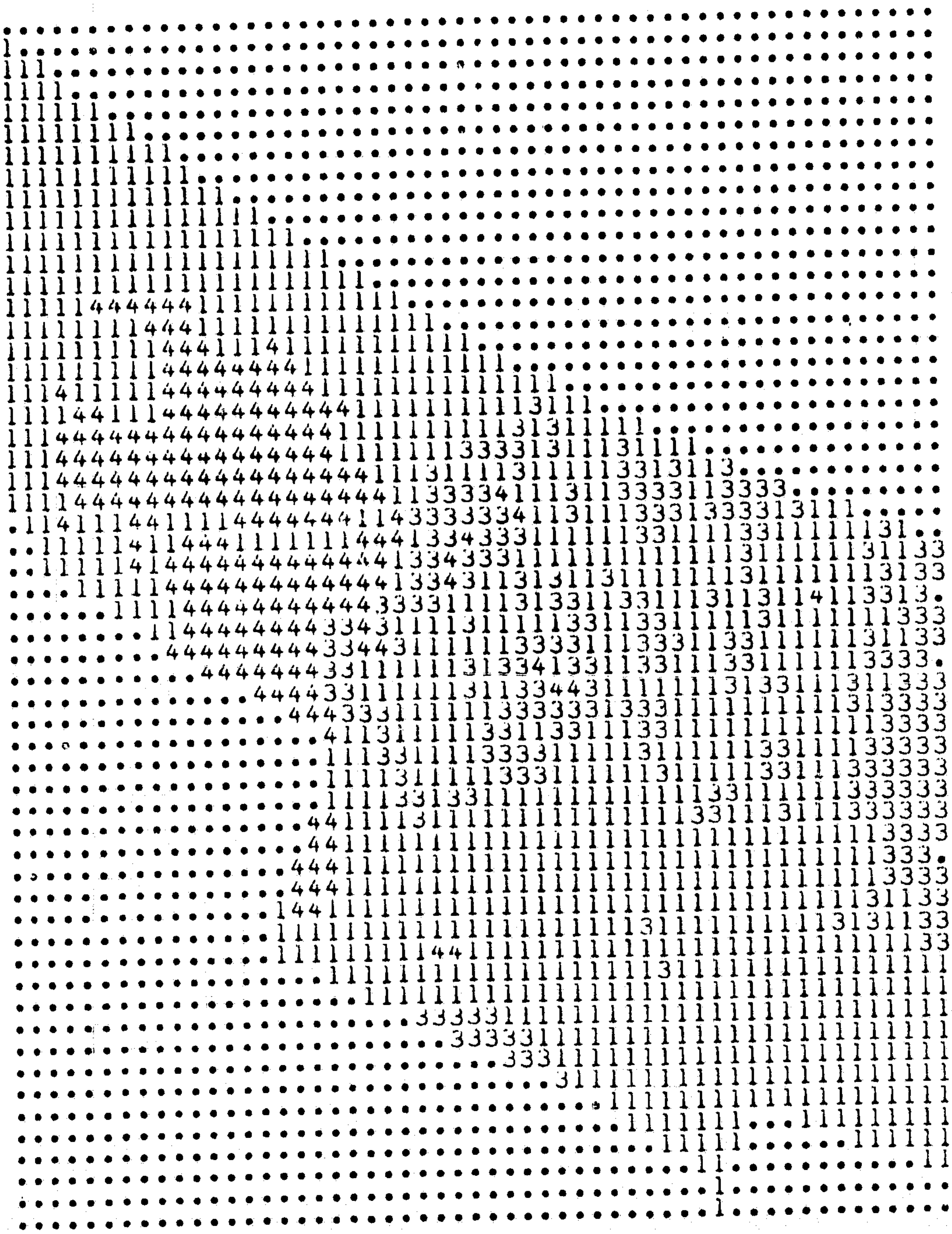
```
      SUBROUTINE OPENHS
      INTEGER*2 SOILA(54,56),STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      INTEGER*2 CHAR(6)/'.','1','2','3','4','5'/
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,
     X CRD,SOIL,PLNDAT,TSTSIT
      COMMON/SLAR/SOILA
      CALL HSTOPN(II)
      DO 10 I=1,54
      DO 10 J=1,56
10    SOILA(I,J)=0
      RETURN
      ENTRY CLOSHS
      CALL HSTCLS
      DO 20 I=1,54
      DO 20 J=1,56
      K=SOILA(I,J)+1
20    SOILA(I,J)=CHAR(K)
      WRITE(6,2000)
      WRITE(6,2001)((SOILA(I,J),I=1,54),J=1,56)
      WRITE(6,2002)
2000  FORMAT(1H1,//,60X,'SOIL MAP',/)
2001  FORMAT(40X,54A1)
2002  FORMAT(1H1,//)
      RETURN
      END
```

3.1.2.7 SAMPLE OUTPUT:

I	J	K	STATE	CRD	CO.	SOIL	
206	335	1	0	0	0	0	****
206	335	2	1	2	11	1	1
206	335	3	0	0	0	0	****
206	335	4	0	0	0	0	****
206	336	1	1	2	11	1	2
206	336	2	1	2	11	1	3
206	336	3	1	2	11	1	4
206	336	4	1	2	11	1	5
206	337	1	1	2	15	1	6
206	337	2	1	2	15	1	7
206	337	3	1	2	11	1	8
206	337	4	1	2	11	1	9
206	338	1	1	2	16	1	10
206	338	2	1	2	16	1	11
206	338	3	1	2	16	1	12
206	338	4	1	2	15	1	13
206	339	1	1	2	16	1	14
206	339	2	1	2	16	1	15
206	339	3	1	2	16	1	16
206	339	4	1	2	16	1	17
206	340	1	1	4	29	1	18
206	340	2	1	4	29	1	19
206	340	3	1	4	29	1	20
206	340	4	1	4	29	1	21
206	341	1	1	4	34	1	22
206	341	2	1	4	34	1	23
206	341	3	1	4	29	1	24
206	341	4	1	4	29	1	25
206	342	1	1	4	34	1	26
206	342	2	1	4	34	1	27
206	342	3	1	4	34	1	28
206	342	4	1	4	34	1	29
206	343	1	1	4	34	1	30
206	343	2	1	4	34	1	31
206	343	3	1	4	34	1	32
206	343	4	1	4	34	1	33
206	344	1	1	6	44	1	34
206	344	2	1	6	43	1	35
206	344	3	1	6	43	1	36
206	344	4	1	6	43	1	37
206	345	1	1	6	44	1	38
206	345	2	1	6	44	1	39
206	345	3	1	6	43	1	40
206	345	4	1	6	44	1	41
206	346	1	1	6	45	1	42
206	346	2	0	0	0	0	****
206	346	3	1	6	44	1	43
206	346	4	1	6	45	1	44
206	347	1	0	0	0	0	****
206	347	2	0	0	0	0	****
206	347	3	0	0	0	0	****
206	347	4	0	0	0	0	****
206	348	1	0	0	0	0	****
206	348	2	0	0	0	0	****

STATE	CRD	CO.	NO. CELLS	
1			519	
1	2		127	
1	3		119	
1	4		87	
1	5		80	
1	7		106	
1		11	10	20
1		12	11	22
1		13	7	14
1		14	16	32
1		15	5	10
1		16	9	18
1		17	21	42
1		18	21	42
1		19	27	54
1		20	26	78
1		21	8	24
1		22	9	27
1		23	13	39
1		24	25	75
1		25	14	42
1		26	12	36
1		27	12	36
1		29	12	48
1		30	8	32
1		31	23	92
1		32	10	40
1		34	12	48
1		35	7	28
1		36	6	24
1		37	9	36
1		43	4	24
1		44	10	60
1		45	8	48
1		46	15	90
1		47	6	36
1		48	10	60
1		49	27	162
1		50	9	63
1		51	4	28
1		52	27	189
1		53	21	147
1		54	8	56
1		55	17	119
1		56	20	140
2			426	
2	1		80	
2	2		51	
2	3		38	
2	4		59	
2	5		43	
2	6		36	
2	7		45	
2	8		43	
2	9		31	
2		1	14	14
2		2	14	14
2		3	15	15
2		4	13	13
2		5	12	12
2		6	12	12
2		7	5	10
2		8	7	14
2		9	4	8
2		10	7	14
2		11	10	20
2		12	5	10
2		13	5	10
2		14	8	16

SOIL MAP



3.1.3 HISTUP

3.1.3.1 Functional Description

The program HISTUP performs the following functions:

1) adds i, j planting date to agronomic historic file;

2) adds i, j start BMT to agronomic historic file;

3) generates the final version of the agronomic historic file.

3.1.3.2 Mathematical Description

- None -

3.1.3.3 HISTUP EXECUTION

Job Control Language

```
//HISTUP JOB (BT9001,746),BELKNAP,CLASS=F
//S2 EXEC FORTGCLG PARM.FORT='ID,MAP',TIME.GO=5
//FORT.SYSIN DD *

                    -  Source Deck  -

//LKED.SYSLIB DD
//            DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.FT31F001 DD DSN=HIST.G1,DISP=(NEW CATLG),UNIT=2314,
// SPACE=(CYL,(10),RLSE,CONTIG)
//  VOL=SER=IPIWRK,DCB=(RECFM=F,BLKSIZE=40)
//GO.FT32F001 DD DUMMY,DCB=BLKSIZE=80
//HISTORIC DD DSN=HISTS,DISP=(OLD,DELETE,KEEP)
/*
//
```

Data Definition Description

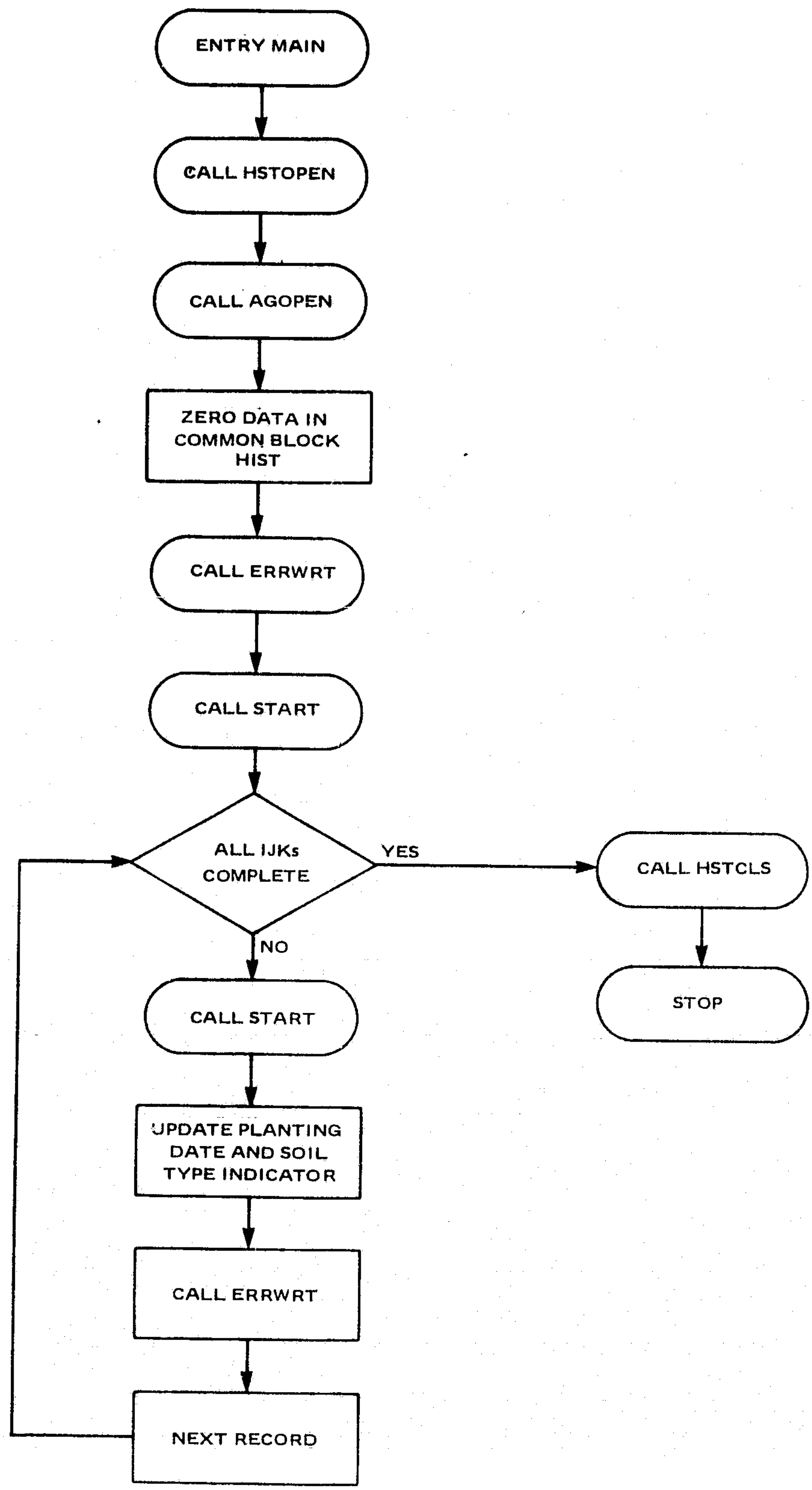
LKED STEP
SYSLIB - Makes available general use subroutines generated by EarthSat

GO STEP
FT05F001 - No data cards
FT06F001 - Printer output (Section 3.1.3.7)
FT31FØØ1 - Final agronomic historic file
FT32FØØ1 - Dummy file
HISTORIC - Intermediate agronomic historic file

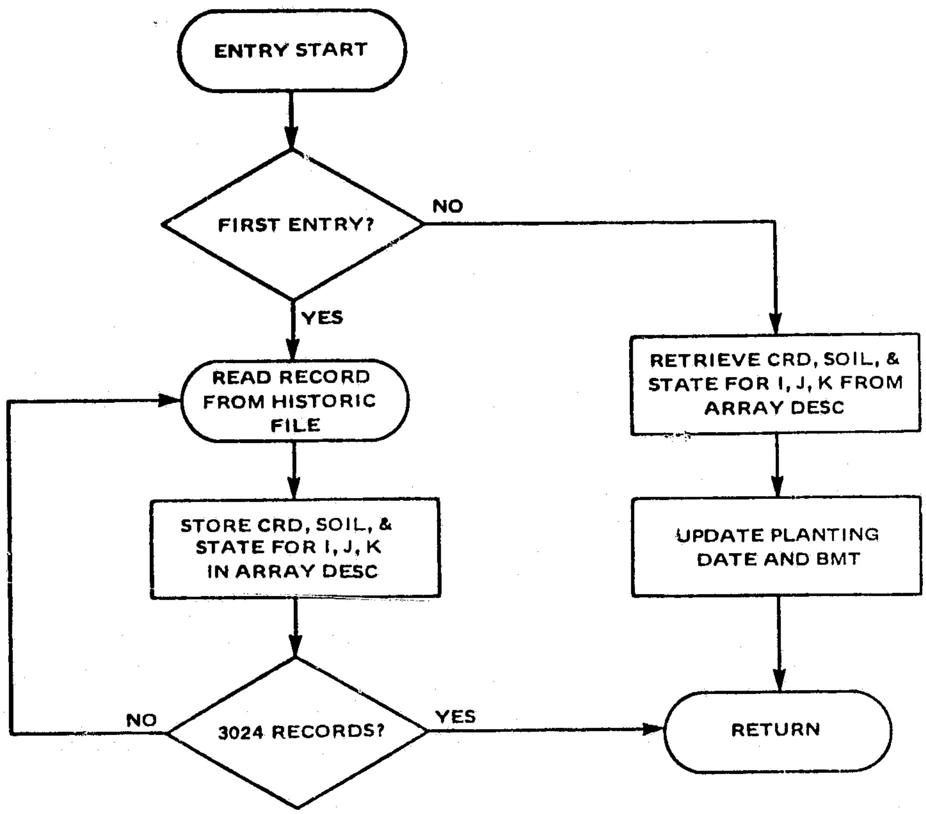
3.1.3.4 DATA DESCRIPTION

- none -

3.1.3.5 FLOWCHART HISTUP



SUBROUTINE START



3.1.3.6 SOURCE CODE

```
      INTEGER*2 STATF,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      REAL LAT,LON
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,
     XSTATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      CALL HSTOPN(II)
      CALL AGOPEN
      II=0
      JJ=0
      KK=0
      LAT=0.
      LON=0.
      YLDTND=0.
      YLDADF=0.
      STATE=0
      COUNTY=0
      CRD=0
      SOIL=0
      PLNDAT=0
      TSTSIT=0
      CALL ERRWRT(II)
      CALL START(1,1,1,IPL,BMT,ISOIL,IST,ICRD)
      DO 10 L=1,3024
      CALL HSTRD(L)
      I1=II-205
      J1=JJ-334
      K1=KK
      CALL START(I1,J1,K1,IPL,BMT,ISOIL,IST,ICRD)
      PLNDAT=IPL
      IF(SOIL.EQ.4)SOIL=27
      IF(SOIL.EQ.3)SOIL=14
      CALL ERRWRT(II)
10    CONTINUE
      CALL HSTCLS
      STOP
      END
```

```
      SUBROUTINE START(I,J,K,PLDAT,BMT,ISOIL,IST,ICRD)
      INTEGER*2 STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      INTEGER*2 PLDCRD(9,4)/137,145,143,145,147,146,144,0,0,
     X 144,132,131,127,122,127,132,113,117,
     X 150,148,143,146,146,146,150,143,138,
     X 137,137,0,130,130,0,123,123,0/
      INTEGER*2 DESC(4,28,27)/3024*0/
      REAL LAT,LON
      INTEGER PLDAT
      REAL BMTS(9,4)/1.27,0.7,0.82,0.7,0.5,0.64,0.73,0.,0.,
     X 0.7,1.5,1.53,1.75,1.95,1.75,1.50,2.40,2.05,
     X 0.09,0.27,0.73,0.45,0.45,0.45,0.09,0.73,1.14,
     X 1.24,1.24,0.00,1.52,1.52,0.00,1.81,1.81,0.00/
      DATA NCP/0/
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,CRD,
     X SOIL,PLNDAT,TSTSIT
      IF(NCP.GT.0) GO TO 20
      DO 10 IJ=1,3024
      CALL HSTRD(IJ)
      J1=JJ-334
      I1=II-205
      DESC(KK,J1,I1)=100*CRD+10*SOIL+STATE
10    CONTINUE
20    NCP=NCP+1
      IJ=DESC(K,J,I)
      IST=MOD(IJ,10)
      ICRD=IJ/100
      ISOIL=MOD(IJ,100)
      ISOIL=ISOIL/10
      PLDAT=151
      BMT=0.
      IF(IJ.LT.1) RETURN
      PLDAT=PLDCRD(ICRD,IST)
      BMT=BMTS(ICRD,IST)
      RETURN
      END
```

3.2 Meteorological Historic File Generation

Construction of the meteorological historic file requires two programs:

1) STAIJ, which generates the historical station intermediate meteorological station file;
2) METGEN which adds the agronomic information and generates the final meteorological historical file. This file is necessary to proper utilization of meteorological station reports. The record in this file contains:
    1) i, j;
    2) Weights for station reports of six closest stations;
    3) BMT;
    4) planting date.

3.2.1 STAIJ

3.2.1.1 Functional Description

The program STAIJ functions are:

1) for each i, j locate the six closest weather stations;
2) to compute the inverse distance weights of each station;

Records are stored in ascending i, j and each record contains:

1) i, j;
2) six closest station numbers;
3) distance weights for six closest stations.

3.2.1.2 Mathematical Description

Station weights:

$$W_m = \frac{1}{d_m} \cdot \Sigma \frac{1}{d_i}$$

where w_m = station weight

d_m = station m's distance from i, j

d_i = distance by station from i, j

Grid mesh structure:

The equation relating latitude (LAT) to Longitude (LON) to i and j

$i = 257 + r \cos a$

$j = 257 + r \sin a$

where

$r = 249.635 \tan ((90° - LAT)/2)$

$a = 10 - LON$

and longitude is defined as positive in the eastern hemisphere and negative in the western

3.2.1.3 STAIJ EXECUTION

Job Control Language

```
//STAIJ JOB (BT9001,746),HEITKEMPER,CLASS=D
//ST1 EXEC FORTGCLG,REGION.GO=95K,TIME.GO=05
//FORT.SYSIN DD *
                    Fortran Source Code

//GO.SYSIN DD *
  Unit five (FT05F001) data cards

//GO.FT30F001 DD DSN=LHG.STAIJ,UNIT=2400-4,DISP=(NEW,KEEP),
//     DCB=(RECFM=FB,LRECL=66,BLKSIZE=660)
/*
//
```

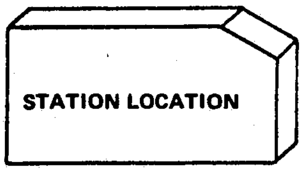
Data Definition Statements Description

GO STEP	
FT05F001(SYSIN)	Card data (Section 2.2.1.4)
FT06F001	Printer file (Section 2.2.1.7)
FT30F001	Intermediate meteorologic historic tape.

3.2.1.4 DATA DESCRIPTION

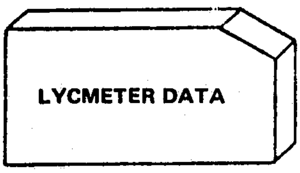
FT05F001 INPUT CARD DATA

1. SEQUENCE



34 CARDS

STATION LOCATION DATA CARD



2 CARDS

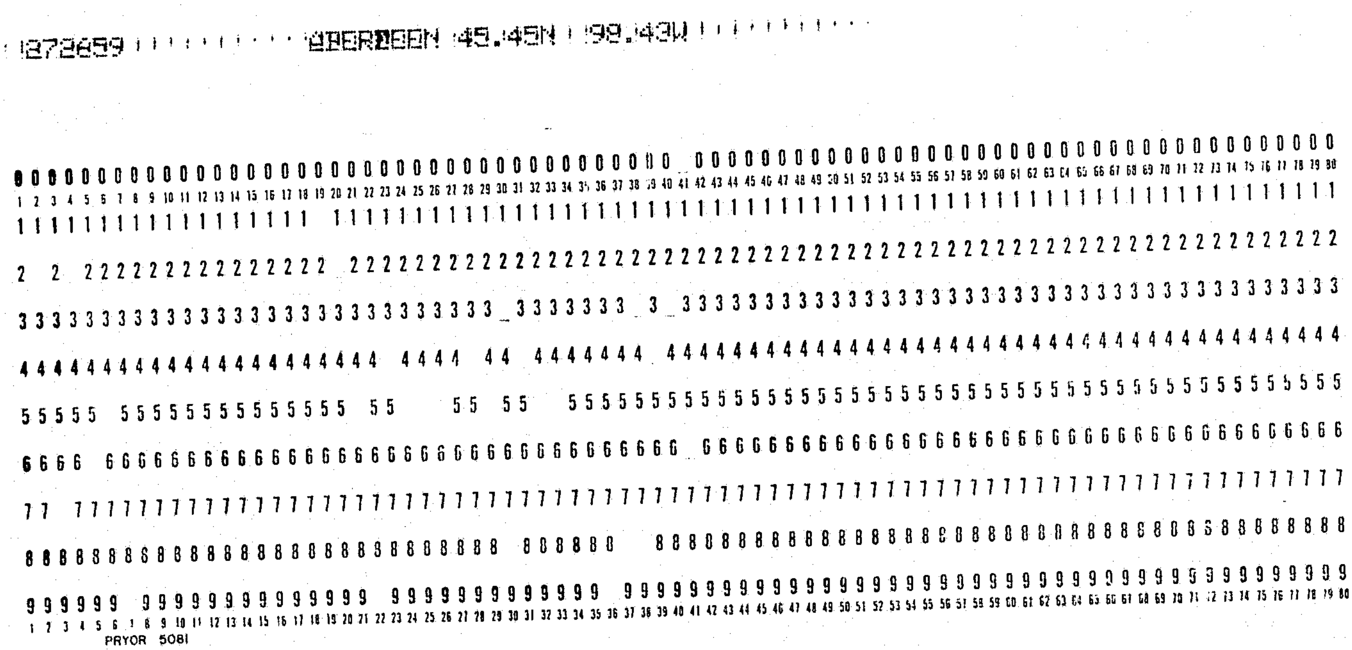
LYCMETER DATA CARD

STATION LOCATION DATA CARD

Format: (I2, I5, 5A4, F5, 1X, F7.2)

VARIABLE	FORMAT	COLS	DESCRIPTION
NUM(I)	I2	1- 2	Ith Station Number
ID(I)	I5	3- 7	Ith Station Identifier
STA(I,1)	A4	8-11	
STA(I,2)	A4	12-15	Ith Station Name
STA(I,3)	A4	16-19	
STA(I,4)	A4	20-23	
STA(I,5)	A4	24-27	
LAT(I)	F5.2	28-32	Ith Station Latitude
LON(I)	F7.2	34-40	Ith Station Longitude

SAMPLE CARD:

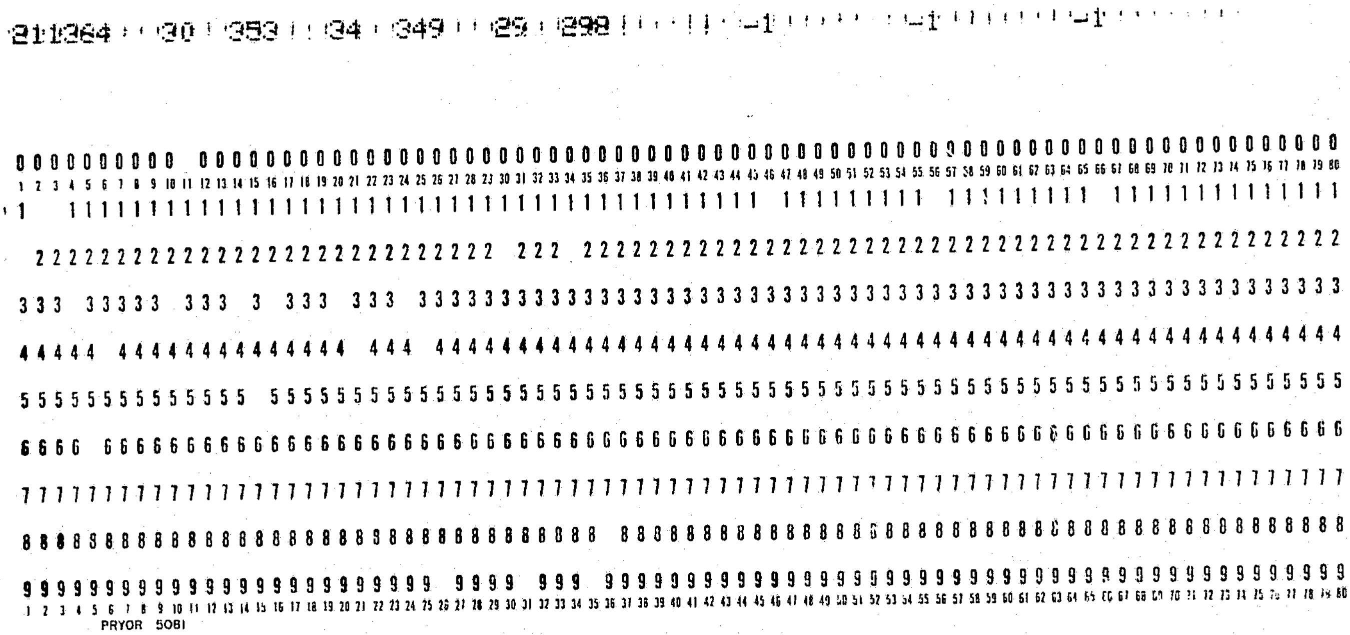


LYCMETER DATA CARD

Format: (2I3, 12I5)

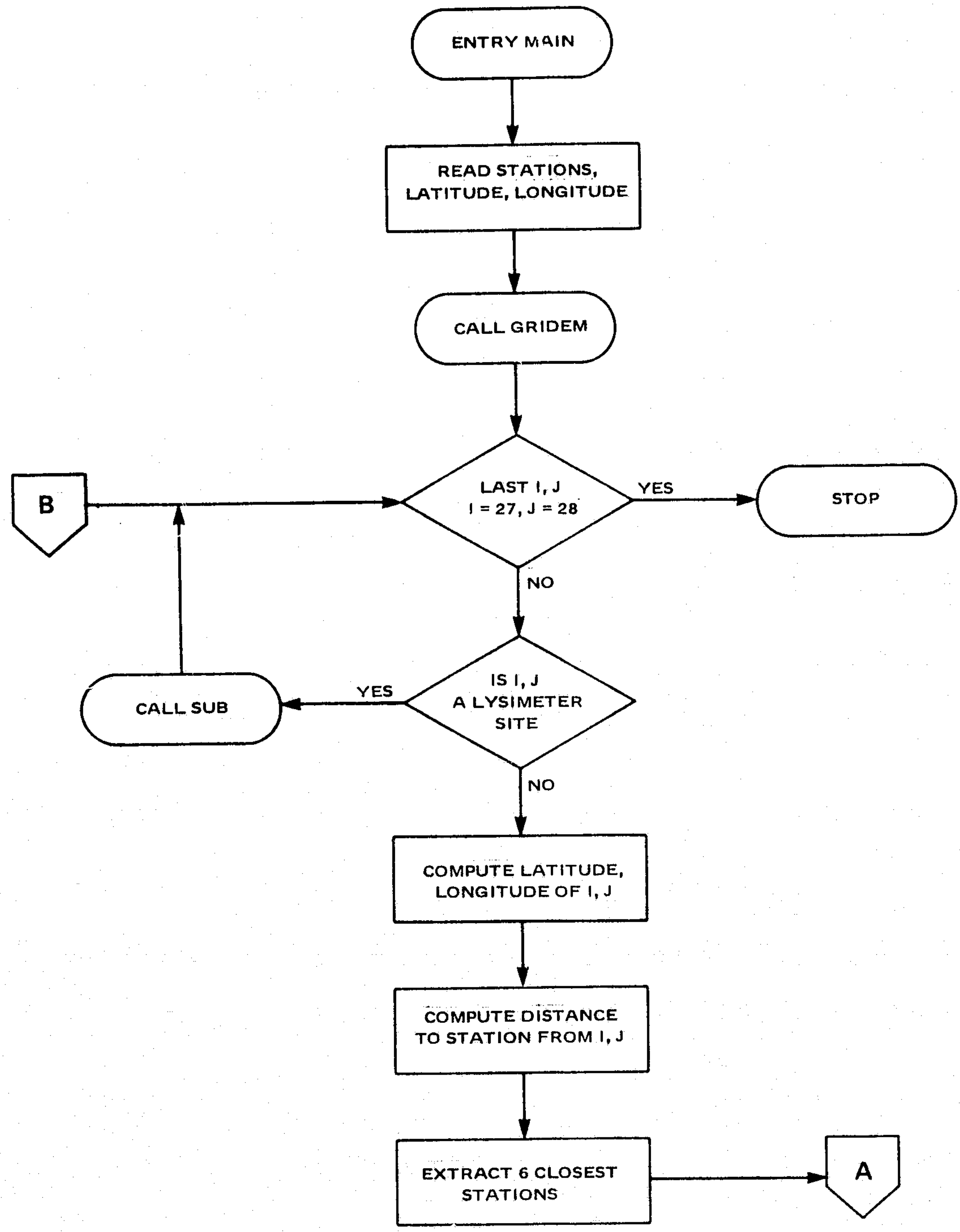
VARIABLE	FORMAT	COLS	DESCRIPTION
I	I3	1- 3	Lycmeter I
J	I3	4- 6	Lycmeter J
I HOLD(1,1)	I5	7-11	1st Station Number
I HOLD(1,2)	I5	12-16	Weight Associated with Station 1
.			
.			
.			
I HOLD(6,1)	I5	57-61	
I HOLD(6,2)	I5	62-66	

SAMPLE CARD:

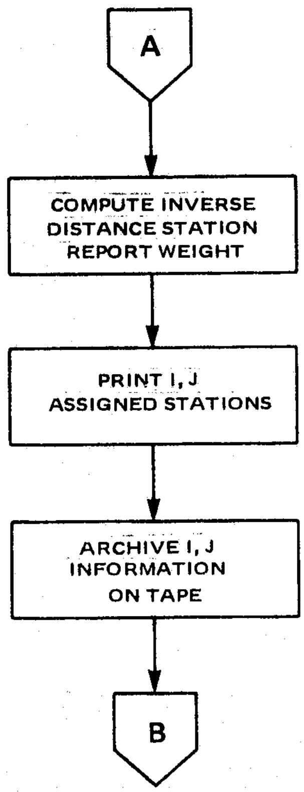


3.2.1.5 FLOWCHART

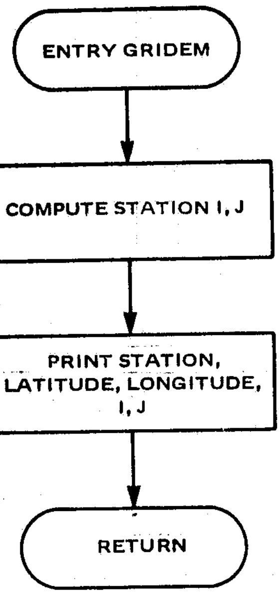
PROGRAM STAIJ



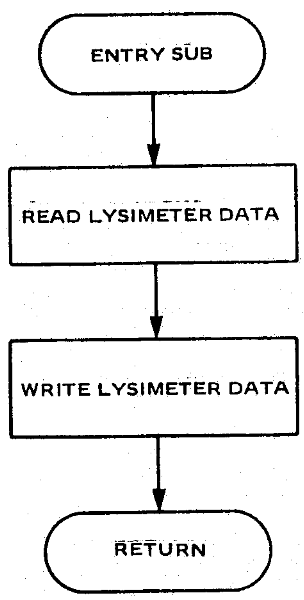
PROGRAM STAIJ



SUBROUTINE GRIDEM



SUBROUTINE SUB



3.2.1.6 SOURCE CODE

```
      INTEGER*2 NUM(50), TODISC(6,2)
      INTEGER*4 STA(50,5) , ID(50)
      REAL*4 LAT(50),LON(50),DIS(50)
      ITOT=34
      LLL=0
      DO 22 I=1,ITOT
      READ (5,10) NUM(I),ID(I),(STA(I,J),J=1,5),LAT(I),LON(I)
      LON(I)=-LON(I)
   22 CONTINUE
   10 FORMAT(I2,I5,5A4,F5.2,1X,F7.2)
      CALL GRIDEM(LAT,LON,ID,STA,ITOT)
      PRINT18
   18 FORMAT(1H1,4X,'I',5X,'J',4X,'STA',4X,'R1',3X,'STA',4X,'R2',
     * 3X,'STA',4X,'R3',3X,'STA',4X,'R4',3X,'STA',4X,'R5',
     * 3X,'STA',4X,'R6')
      DO 1 I=206,232
      DO 1 J=335,362
      LLL=LLL+1
      IF (LLL .NE. 58) GO TO 414
      PRINT18
      LLL=0
  414 IF(I .EQ. 206 .AND. J .EQ. 361) CALL SUB
      IF(I .EQ. 206 .AND. J .EQ. 361) GO TO 1
      IF(I .EQ.206 .AND. J .EQ. 362) CALL SUB
      IF(I .EQ.206 .AND. J .EQ. 362) GO TO 1
      F1=257.-I
      F2=257.-J
      F3=I-257.
      Y=ATAN(F1/F2)
      CLON=1.3962632-Y
      CLAT=1.571-2*ATAN(F3/(249.635*SIN (Y)))
      DO 2 L=1,ITOT
      NUM(L)=L
      DSUB=COS (1.571-LAT(L)*.01745329)*COS (1.571-CLAT)
     * +SIN (1.571-LAT(L)*.01745329)*SIN (1.571-CLAT)
     * *COS (LON(L)*.01745329-CLON)
      DSUB=ARCOS(DSUB)
      DIS(L)=DSUB*3437.748
    2 CONTINUE
      DO 3 K=1,6
      L=K+1
      DO 4 M=L,ITOT
      IF (DIS(K) .LT. DIS(M)) GO TO 4
      D=DIS(K)
      N=NUM(K)
      DIS(K)=DIS(M)
```

```
      NUM(K)=NUM(M)
      DIS(M)=D
      NUM(M)=N
    4 CONTINUE
    3 CONTINUE
      DTOT=0.0
      DO 7 K=1,6
      DTOT=(1./DIS(K))+DTOT
    7 CONTINUE
      DO 5 K=1,6
      TODISC(K,1)=NUM(K)
      TODISC(K,2)=(1./(DIS(K)*DTOT))*1000.
    5 CONTINUE
      WRITE(30,111) I,J,((TODISC(K,L),L=1,2),K=1,6 )
  111 FORMAT(2I3,12I5)
      WRITE (6,110) I,J, ((TODISC(K,L),L=1,2),K=1,6)
  110 FORMAT(1X,2I6,12I6)
    1 CONTINUE
      END
```

```
      SUBROUTINE GRIDEM(LAT,LON,ID,STA,ITOT)
      INTEGER*4 STA(50,5) , ID(50)
      REAL*4 LAT(50),LON(50)
      PRINT 8
    8 FORMAT(1H1)
      PRINT 10
   10 FORMAT(7X,'ID',12X,'STATION',10X,'LAT',5X,'LON',6X,'I',7X,'J')
      DO 11 I=1,ITOT
      R=249.635*TAN((1.571-LAT(I)*.01745329)/2.)
      A=.1745329-LON(I)*.01745329
      C=257.+R*COS (A)
      D=257.+R*SIN (A)
      LON(I)=-LON(I)
      PRINT 2,I,ID(I),(STA(I,J),J=1,5),LAT(I),LON(I),C,D
    2 FORMAT(1X,I2,2X,I5,4X,5A4,3X,F5.1,'N',2X,F5.1,'W',2X,
     * F5.1,3X,F5.1)
   11 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SUB
      INTEGER*2 IHOLD(6,2)
      READ (5,210) I,J, ((IHOLD(K,L),L=1,2),K=1,6)
      WRITE (30,210) I,J,((IHOLD(K,L),L=1,2),K=1,6)
      WRITE(6,211)   I,J,((IHOLD(K,L),L=1,2),K=1,6)
  210 FORMAT(2I3,12I5)
  211 FORMAT(1X,2I6,12I6)
      RETURN
      END
```

3.2.1.7 STAIJ SAMPLE OUTPUT

I	J	STA	R1	STA	R2	STA	R3	STA	R4	STA	R5	STA	R6
214	342	14	760	13	54	26	51	15	50	25	41	24	40
214	343	14	572	15	101	13	89	20	80	26	80	24	75
214	344	14	394	15	152	20	126	13	114	24	108	21	104
214	345	14	296	15	175	20	153	21	135	24	120	13	117
214	346	14	239	15	183	20	170	21	166	24	125	13	114
214	347	14	199	21	195	15	177	20	176	4	129	24	122
214	348	21	220	20	172	14	168	15	164	4	151	16	122
214	349	21	237	4	179	20	162	15	150	14	145	16	125
214	350	21	241	4	217	20	150	15	136	14	127	16	126
214	351	4	271	21	230	20	137	16	124	15	122	14	112
214	352	4	343	21	204	20	120	16	116	29	107	15	107
214	353	4	432	21	167	29	108	16	102	20	100	15	89
214	354	4	507	21	132	29	107	16	86	11	83	20	82
214	355	4	497	29	121	21	119	11	94	16	83	7	83
214	356	4	413	29	152	21	120	11	119	7	97	34	96
214	357	4	328	29	183	11	146	21	117	34	113	7	110
214	358	4	259	29	205	11	173	34	126	30	117	7	116
214	359	29	214	4	205	11	198	34	134	30	130	7	116
214	360	11	226	29	211	4	165	30	144	34	139	7	112
214	361	11	256	29	197	30	162	34	141	4	136	7	107
214	362	11	232	30	187	29	176	34	140	4	113	7	99
215	335	26	391	27	167	25	127	13	116	14	102	28	94
215	336	26	563	27	110	25	95	13	86	14	80	28	62
215	337	26	875	25	28	27	28	14	25	13	25	24	16
215	338	26	473	14	127	25	117	13	107	27	101	24	73
215	339	26	307	14	202	25	144	13	133	27	111	15	100
215	340	14	291	26	212	25	140	13	133	15	115	24	106
215	341	14	424	26	139	15	114	25	113	13	109	24	98
215	342	14	595	15	95	26	82	24	75	25	75	13	74
215	343	14	507	15	135	24	97	26	88	25	86	13	85
215	344	14	370	15	190	24	125	20	107	13	102	25	102
215	345	14	286	15	218	24	138	20	128	21	120	13	107
215	346	14	233	15	222	21	144	20	142	24	140	16	117
215	347	15	212	14	198	21	167	20	150	24	137	4	132
215	348	15	192	21	185	14	170	4	158	20	150	16	142
215	349	21	197	4	190	15	171	14	148	16	147	20	145
215	350	4	234	21	199	15	151	16	148	20	136	14	130
215	351	4	296	21	190	16	142	15	132	20	125	14	113
215	352	4	387	21	167	16	128	15	110	20	108	29	98
215	353	4	521	21	126	16	99	29	88	20	81	15	81
215	354	4	716	21	69	29	57	16	56	11	50	7	49
215	355	4	671	29	72	21	71	11	64	7	59	16	59
215	356	4	483	29	120	11	111	21	99	7	96	5	88
215	357	4	362	29	153	11	151	7	120	21	107	5	104
215	358	4	278	11	186	29	172	7	131	30	115	34	115
215	359	11	221	4	216	29	178	7	132	30	128	34	121
215	360	11	263	29	173	4	170	30	141	7	127	34	123
215	361	11	314	29	159	30	152	4	135	34	120	7	117
215	362	11	369	30	166	29	138	34	113	4	107	7	104
216	335	26	332	25	157	27	147	13	112	14	108	28	91
216	336	26	485	25	139	27	111	14	95	13	92	24	74
216	337	26	546	25	128	14	91	27	86	13	79	24	67
216	338	26	413	25	167	14	132	13	99	27	97	24	90
216	339	26	288	25	188	14	186	13	113	24	112	15	110
216	340	14	245	26	206	25	178	15	130	24	125	13	112
216	341	14	313	26	152	25	151	15	147	24	131	13	103
216	342	14	362	15	168	24	132	25	125	26	117	13	93
216	343	14	343	15	208	24	140	25	114	26	103	13	90

3.2.2 METGEN

3.2.2.1 Functional Description

The program METGEN's functions are:

1) add i, j start BMT to meteorological or historic file;

2) add i, j planting date to meteorological historic file;

3) generate final version of meteorological historic file.

3.2.2.2 Mathematical Description

- None -

3.2.2.3 METGEN EXECUTION

Job Control Language

```
//METGEN JOB (BR9001,746),ANDERSON,CLASS=F
//    EXEC FORTGCLG,PARM.FORT='MAP,ID',TIME.GO=5
//FORT.SYSIN DD *
```

- Source Deck -

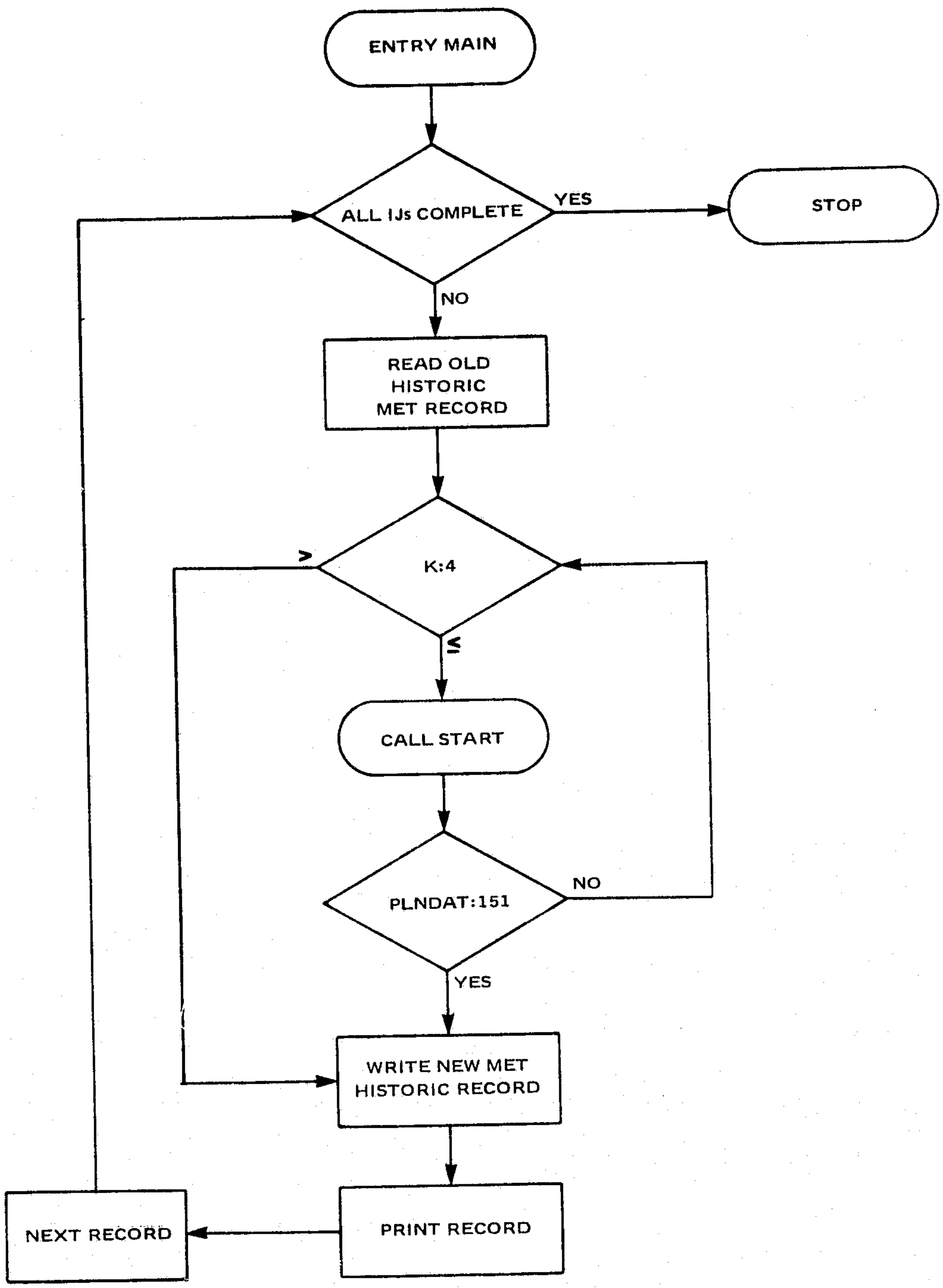
```
//LKED.SYSLIB DD
//    DD  DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.FT08F001 DD DSN=LJH.STAIJ,DISP=(OLD,KEEP,KEEP)
//GO.FT09F001 DD DSN=RWA.STAIJ,DISP=(NEW,CATLG),
// UNIT=2400,DCB=(RECFM=FB,LRECL=76,BLKSIE=760)
//HISTORIC DD DSN=HIST.G1,DISP=(OLD,KEEP),UNIT=2314,
//  VOL=SER=IPIWRK,DCB=(RECFM=F,BLKSIZE=40)
/*
//
```

Data Definition Description

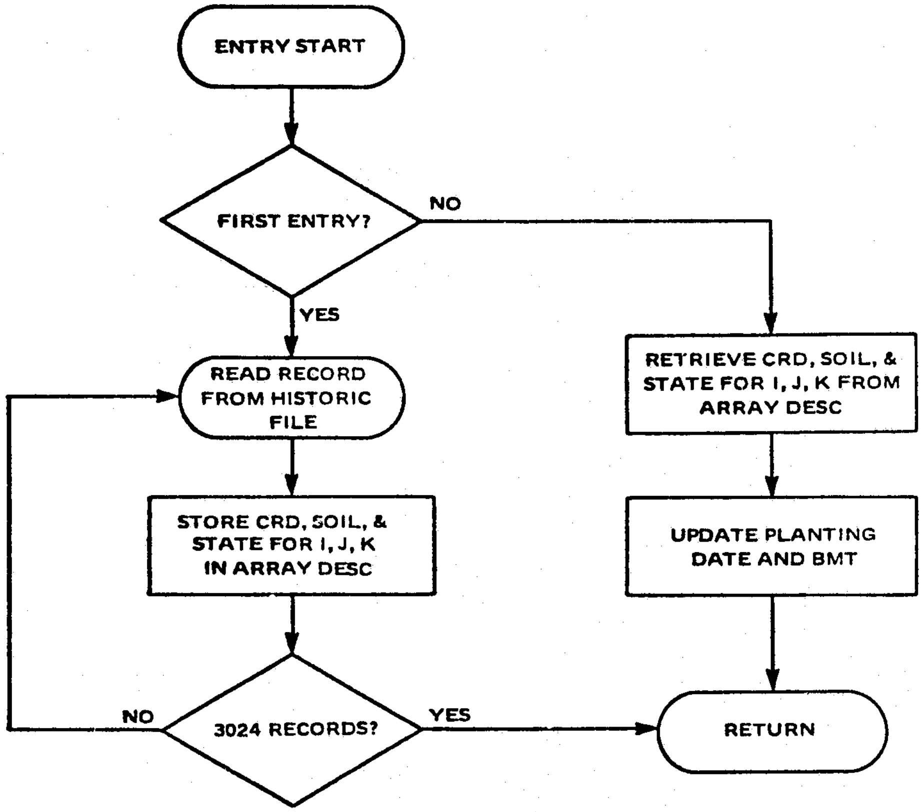
LKED STEP
- SYSLIB - Makes available additional general use subroutines supplied by EarthSat

GO STEP
- FT05F001 - No data cards
- FT06F001 - Printer output
- FT08F001 - Input intermediate file created by program STAIJ
- FT09F001 - Output file final meteorologic
- HISTORIC - Agronomic historic file

3.2.2.5 FLOWCHART METGEN



SUBROUTINE START



3.2.2.6 SOURCE CODE

```
      INTEGER*2 ARRAY(20)
      INTEGER*2 INPUT(16)
      INTEGER PLNDAT
      DO 6 I=1,27
      DO 8 J=1,28
      READ(9,1001) (INPUT(II),II=1,14)
      DO 7 K=1,4
      CALL START(I,J,K,PLNDAT,BMT)
      IF(PLNDAT.NE.151) GO TO 15
  7   CONTINUE
 15   CONTINUE
      INPUT (15)=PLNDAT
      INPUT(16)=BMT*1000.

      WRITE(8,1002)INPUT
 8    CONTINUE
  6   CONTINUE

 1001 FORMAT(2I3,12I5)
 1002 FORMAT(2I3,14I5)
      STOP
      END
```

```
      SUBROUTINE START(I,J,K,PLDAT,BMT)
      INTEGER*2 STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      INTEGER*2 PLDCRD(9,4)/137,145,143,145,147,146,144,0,0,
     X 144,132,131,127,122,127,132,113,117,
     X 150,148,143,146,146,146,150,143,138,
     X 137,137,0,130,130,0,123,123,0/
      INTEGER*2 DESC(4,28,27)/3024*0/
      REAL LAT,LON
      INTEGER PLDAT
      REAL BMTS(9,4)/1.27,0.7,0.82,0.7,0.5,0.64,0.73,0.,0.,
     X 0.7,1.5,1.53,1.75,1.95,1.75,1.50,2.40,2.05,
     X 0.09,0.27,0.73,0.45,0.45,0.45,0.09,0.73,1.14,
     X 1.24,1.24,0.00,1.52,1.52,0.00,1.81,1.81,0.00/
      DATA NCP/0/
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,CRD,
     X SOIL,PLNDAT,TSTSIT
      IF(NCP.GT.0) GO TO 20
      CALL HSTOPN(II)
      DO 10 IJ=1,3024
      CALL HSTRD(IJ)
      J1=JJ-334
      I1=II-205
      DESC(KK,J1,I1)=100*CRD+10*SOIL+STATE
10    CONTINUE
20    NCP=NCP+1
      IJ=DESC(K,J,I)
      IST=MOD(IJ,10)
      ICRD=IJ/100
      ISOIL=MOD(IJ,100)
      ISOIL=ISOIL/10
      PLDAT=151
      BMT=0.
      IF(IJ.LT.1) RETURN
      PLDAT=PLDCRD(ICRD,IST)
      BMT=BMTS(ICRD,IST)
      RETURN
      END
```

3.3 Initial Season Agronomic File Generation

Construction of the season agronomic file is accomplished by the program INITIAL. This file contains the following information:

1) i, j, k;
2) Julian date;
3) soil moisture, three-layer capacity;
4) ET of each layer;
5) ETP;
6) average ETP;
7) precipitation;
8) average stress;
9) maximum and minimum temperature;
10) total to-date runoff;
11) stress and BMT interval;
12) number of days in BMT interval;
13) number of crop days;
14) soil type;
15) net radiation.

This file is the prototype of the file used in the agronomic growth section for the storage and retrieval of daily growth results.

3.3.1 INITIAL

3.3.1.1 Functional Description

The program INITIAL's functions are:

1) to initialize the agronomic variables and constants;
2) to locate geographically each i, j, k in the square matrix;
3) to generate the initial season agronomic growth file.

3.3.1.2 Mathematical Description

- None -

3.3.1.3 INITIAL EXECUTION

Job Control Language

```
//INITIAL JOB (BT9001,746),BELKNAP,CLASS=F
//S1 EXEC FORTGCLG,PARM.FORT='ID,MAP',TIME.GO=5
//FORT.SYSIN DD *

                    - Source Deck -

//LKED.SYSLIB DD
//              DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.SYSUDUMP DD SYSOUT=A
//GO.FT10F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//FT31F001    DD DSN=LACIE.START,DISP=(NEW CATLG),UNIT=2314,
//  VOL=SER=IPIWRK,SPACE=(CYL,(10),RLSE,CONTIG),
//  DCB=(RECFM=F,LRECL=108,BLKSIZE=108)
//GO.FT32F001 DD DUMMY,DCB=BLKSIZE=80
//HISTORIC DD DSN=HIST.G1,DISP=(OLD,KEEP),UNIT=2314,
//  VOL=SER=IPIWRK,DCB=(RECFM=F,BLKSIZE=40)
//GO.SYSIN DD *

                    - Unit 5 data deck -

//
```

Data Definition Description

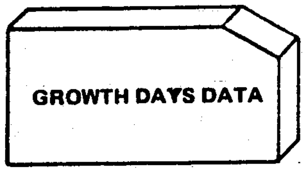
LKED STEP
- SYSLIB - Makes available additional general use subroutines supplied by EarthSat

GO STEP
- FT05F001 - Data file to be read
- FT06F001 - Printer output
- FT31FØØ1 - Output Site-Season agronomic file
- FT32FØØ1 - Unused output file DCB necessary
- HISTORIC - Historical agronomic file

3.3.1.4 DATA DESCRIPTION

FT05F001 INPUT CARD DATA

1. SEQUENCE



INDETERMINATE
NO. OF CARDS

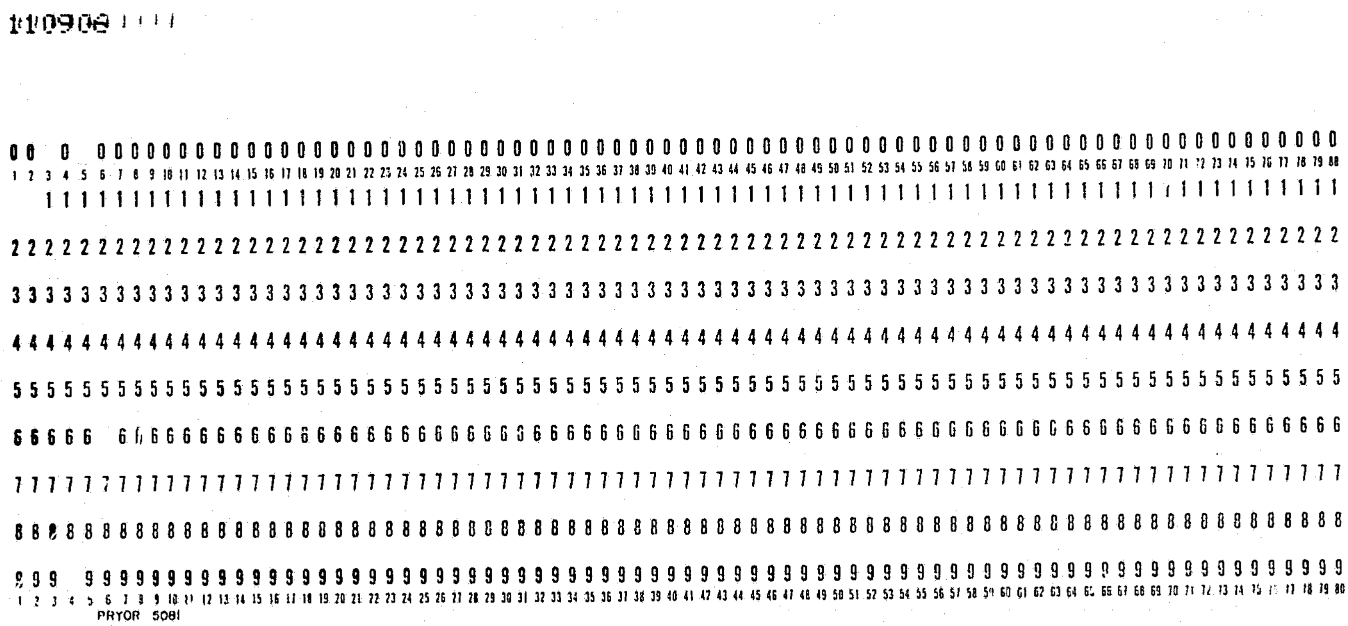
GROWTH DAYS
DATA CARD

GROWTH DAYS DATA CARD

Format: (2I1,5I2)

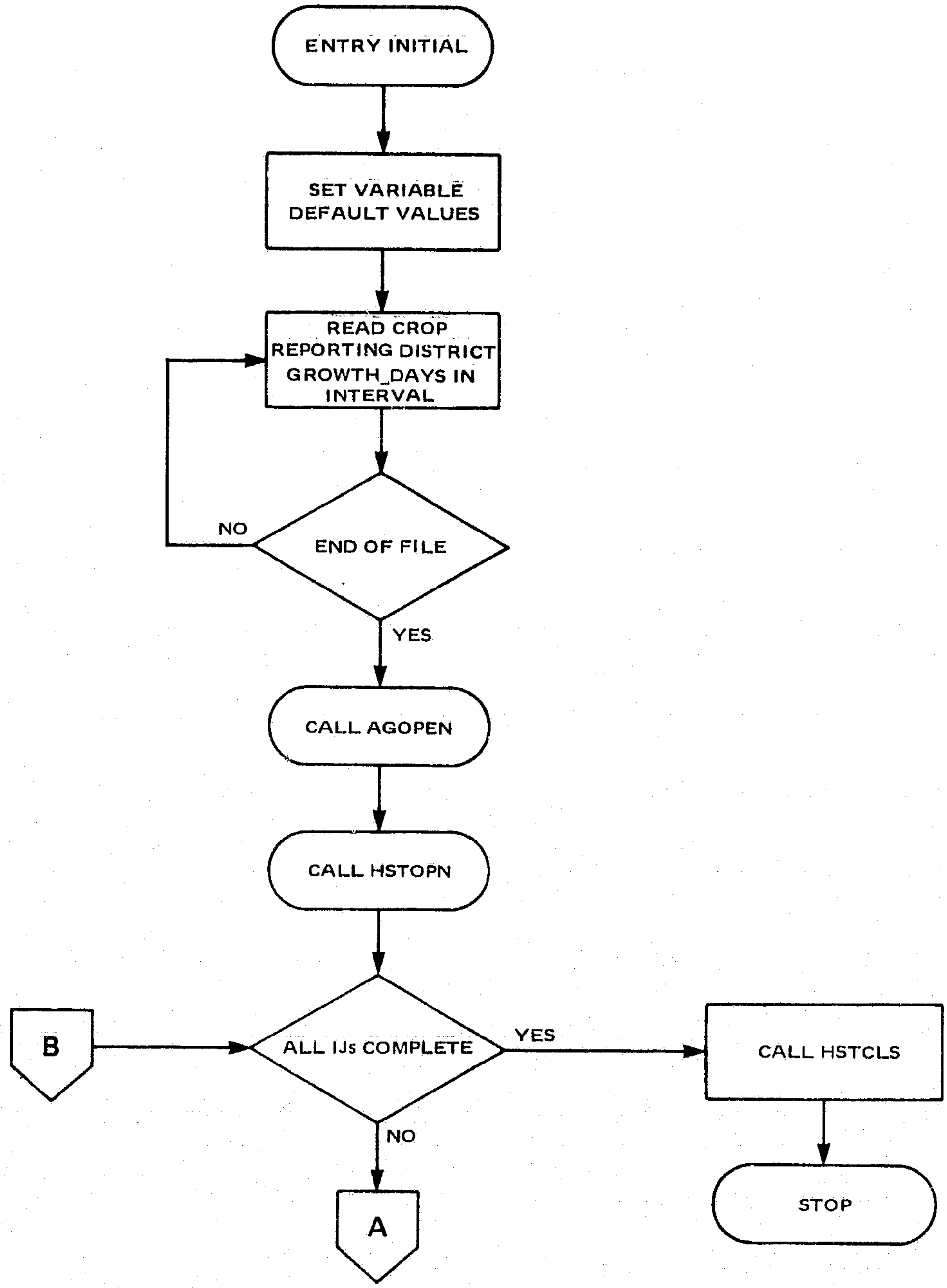
Variable	Format	Cols	Description
IS1	I1	1	State
IC1	I1	2	Crop reporting district
NC(N)	5I2	3-12	Number of days growth in BMT interval N-1 to N for state & CRD

Sample Card:

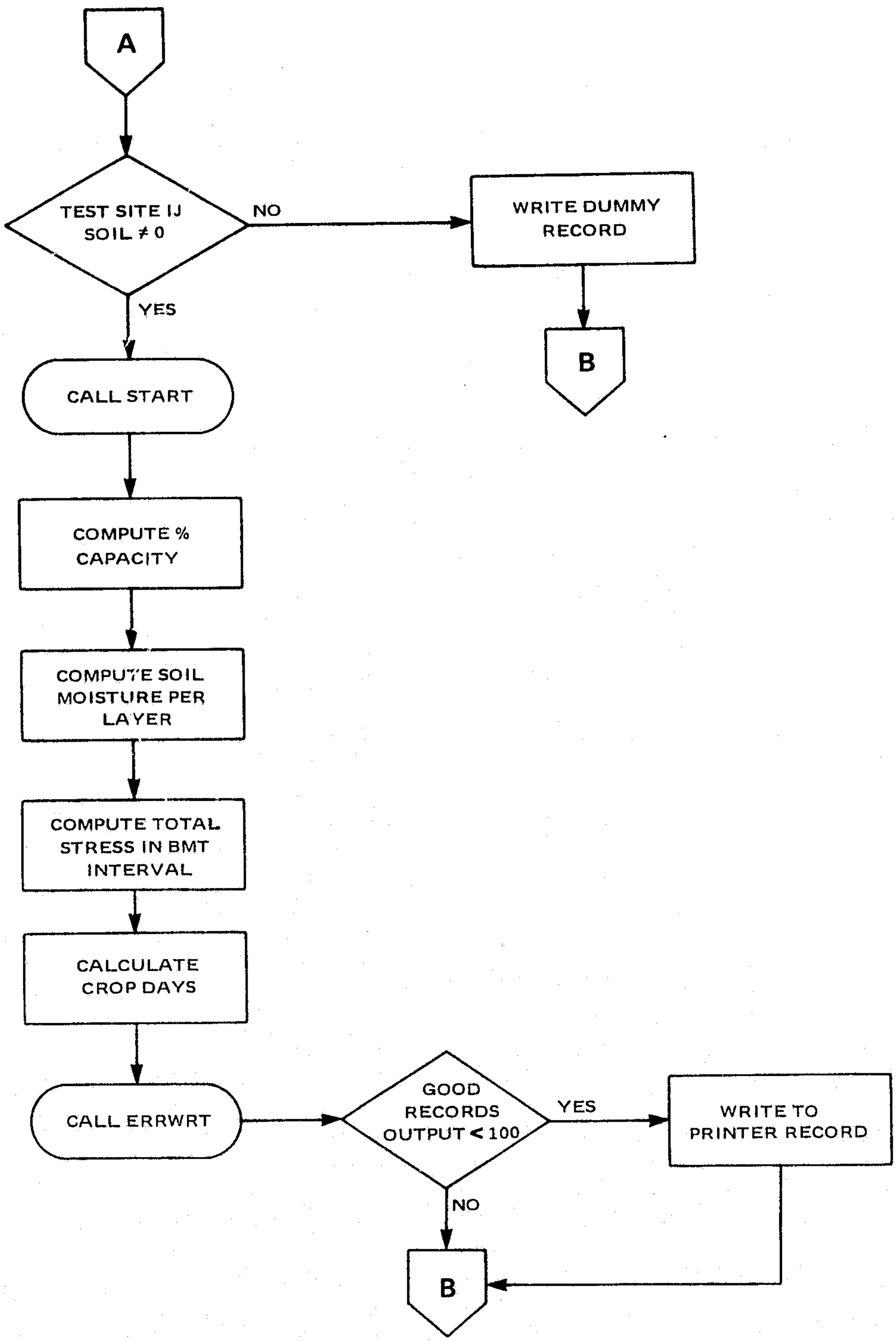


3.3.1.5 FLOWCHART

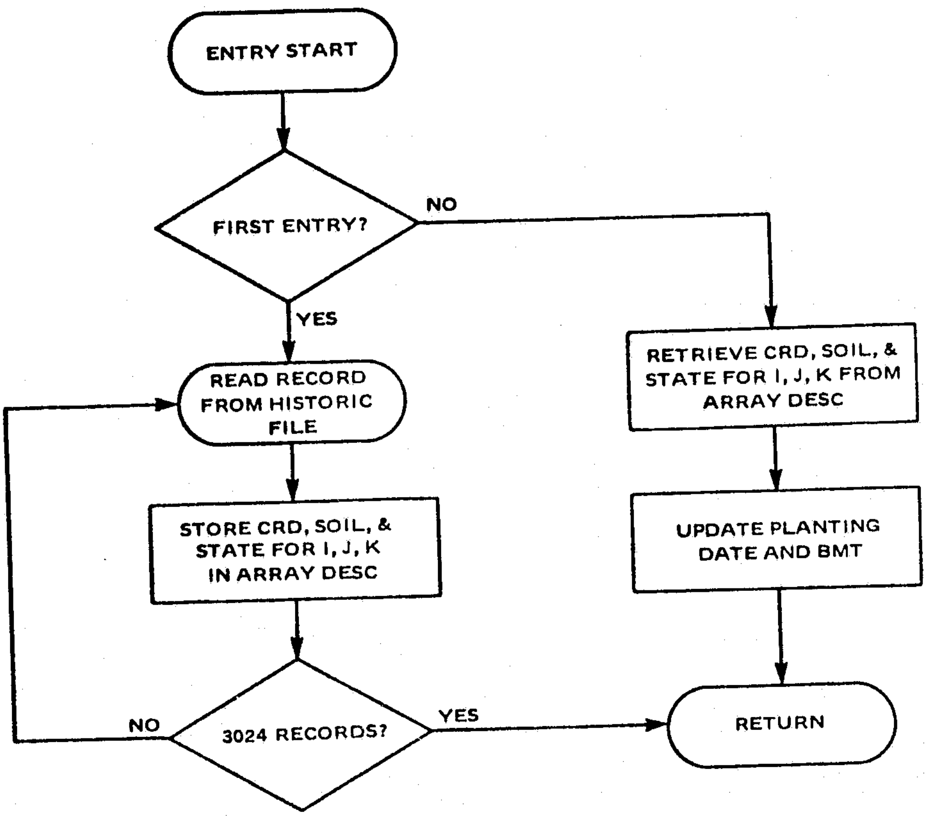
INITIAL



INITIAL


A
TEST SITE IJ SOIL ≠ 0
NO
WRITE DUMMY RECORD
B
YES
CALL START
COMPUTE % CAPACITY
COMPUTE SOIL MOISTURE PER LAYER
COMPUTE TOTAL STRESS IN BMT INTERVAL
CALCULATE CROP DAYS
CALL ERRWRT
GOOD RECORDS OUTPUT < 100
YES
WRITE TO PRINTER RECORD
NO
B

SUBROUTINE START



3.3.1. 6 SOURCE CODE

```
      INTEGER*2 NDAY(5),CRPDAY,TSOIL,RAD,STATE,COUNTY,CRD,SOIL,
     X PLNDAT,TSTSIT,F1,NC(5)
      INTEGER*2 F1,FILLER(53)
      INTEGER*2 NDCRD(5,9,4)/180*0/
      REAL LAT,LON,SM(3),ET(3),STRINT(5)
      INTEGER PLDAT
      REAL FCL(3,6)/8.75,35.,131.25,8.75,35.,131.25,5.75,23.0,86.25,
     115.,60.,0.,8.75,35.,131.25,3*0./
      REAL STSTRS(4)/.3,.5,.4,.3/
      REAL SMI(9,4)/7.97,4.07,2.38,6.87,7.79,7.81,4.64,0.,0.,
     X 5.29,6.15,5.32,3.80,4.46,6.62,3.80,2.41,5.00,
     X 6.00,7.00,5.53,6.29,8.00,8.00,7.35,8.00,7.10,
     X 7.00,7.00,7.00,7.00,8.00,3*8.00/
      REAL CAP(9,4)/9*8.0,5*8.0,6.0,3*8.0,6.0,7.0,7.0,6*8.0,
     X 4*7.0,8.0,7.0,3*8.0/
      COMMON/FILL/F1,FILLER
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,CRD,SOIL,
     XPLNDAT,TSTSIT
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,TMAX,
     X TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
      NOUT=0
      F1=0
      DO 5 J=1,53
5     FILLER(J)=0
      RAD=0
      ETP=0.
      STRESS=0.
      ETPAVE=0.
      TMAX=0.
      TMIN=0.
      TSOIL=0
      JUL=151
      CRNOFF=0.
      PRECIP=0.
      DO 10 IJ=1,3
10    ET(IJ)=0.
12    READ(5,2000,END=15)IS1,IC1,(NC(IJ),IJ=1,5)
2000  FORMAT(2I1,5I2)
      DO 14 IJ=1,5
14    NDCRD(IJ,IC1,IS1)=NC(IJ)
      GO TO 12
15    CONTINUE
      CALL AGOPEN
      CALL HSTOPN(II)
      DO 100 IJK=1,3024
      CALL HSTRD(IJK)
```

```
      I=II
      J=JJ
      K=KK
      I2=I-205
      J2=J-334
      IF(SOIL.NE.0) GO TO 20
C        GENERATE FILLER RECORD
      CALL ERRWRT(F1)
      GO TO 100
C        GROWTH CELL
20    CALL START(I2,J2,K,PLDAT,BMT,ISOIL,IST,ICRD)
      PCT=SMI(ICRD,IST)/CAP(ICRD,IST)
      IF(PCT.GT.1.0) PCT=1.0
      DO 30 JK=1,3
30    SM(JK)=PCT*FCL(JK,ISOIL)
C        CALCULATE CUMULATIVE DAYS AND CUMULATIVE STRESS
      STR=STSTRS(IST)
      DO 40 IJ=1,5
      IK=NDCRD(IJ,ICRD,IST)
      NDAY(IJ)=IK
40    STRINT(IJ)=STR*FLOAT(IK)
      CRPDAY=152-PLDAT
      CALL ERRWRT(I)
      NOUT=NOUT+1
      IF(NOUT.GT.100) GO TO 100
      WRITE(10,2001) I,J,K,JUL,BMT,(SM(I1),I1=1,3),(ET(J1),J1=1,3),
     X ETP,ETPAVE,PRECIP,STRESS,TMAX,TMIN,CRNOFF,(STRINT(K1),K1=1,5),
     X (NDAY(L1),L1=1,5),CRPDAY,TSOIL,RAD
2001  FORMAT(23A4,8A2)
100   CONTINUE
      CALL HSTCLS
      STOP
      END
```

DAILY METEOROLOGICAL DATA EDITS

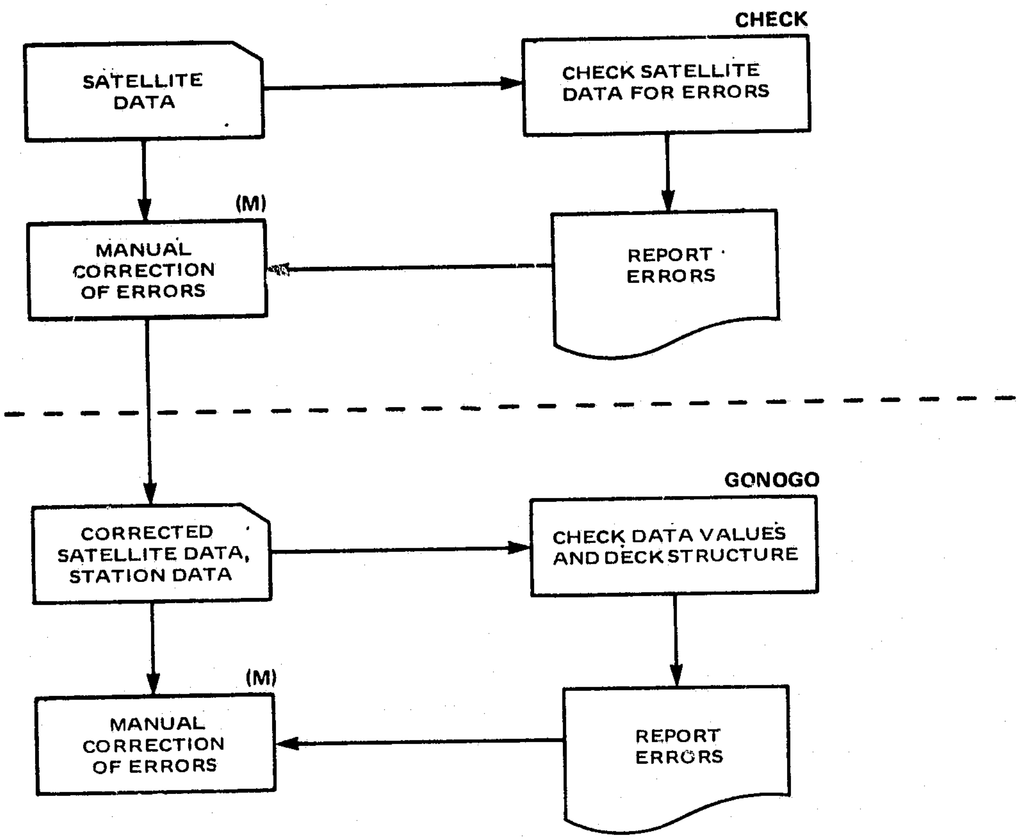


FIGURE 4.1

4.0 METEOROLOGICAL DAILY DATA EDITS

The meteorological system uses as inputs the daily station reports and interpreted satellite imagery. The necessity for correct digital data produced a set of programs (Figure 4.1) to detect and display data errors:

1. CHECK edits satellite data, flagging errors for manual correction.
2. GONOGO checks data input for proper organization.

Both programs print the appropriate meteorological data in a structured printout for analysis by meteorologists. Data which has been processed through these programs then becomes a primary input to the agro-meteorological-pred system.

4.1 Satellite Data Edits

4.1.1 CHECK

4.1.1.1 Functional Description

Interpretation of SMS visible and infrared imagery are manually performed, coded, and the result then keypunched. Manual errors in both the coding and punching process will occur. Detection of these errors is the primary function of the program CHECK. The program CHECK checks the following for consistency:

1) the number of (latitude, longitude) pairs is equal to the number of vertices;
2) the latitude and longitude limits are within the correct limits;
3) the number of cloud intensity eights does not exceed eight.

Each satellite data card is printed for manual verification, and errors printed if detected.

4.1.1.2 Mathematical Description

- none -

4.1.1.3 CHECK EXECUTION

Job Control Language

```
//CHECK JOB (BR9001,746),ANDERSON,CLASS=F
//ST1 EXEC FORTGCLG,PARM.FORT='MAP,ID'
//FORT.SYSIN DD *
```

- Source Deck -

```
//GO.SYSIN DD *
  Unit 5 data cards
/*
//
```

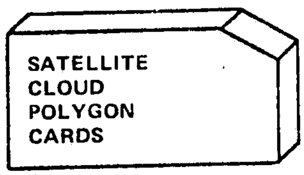
Data Definition Description

FT05F001 - Data cards
FT06F001 - Printer output

4.1.1.4 DATA DESCRIPTION

INPUT DATA CARDS FOR CHECK PROGRAM

1. SEQUENCE



INDETERMINATE
NO. OF CARDS

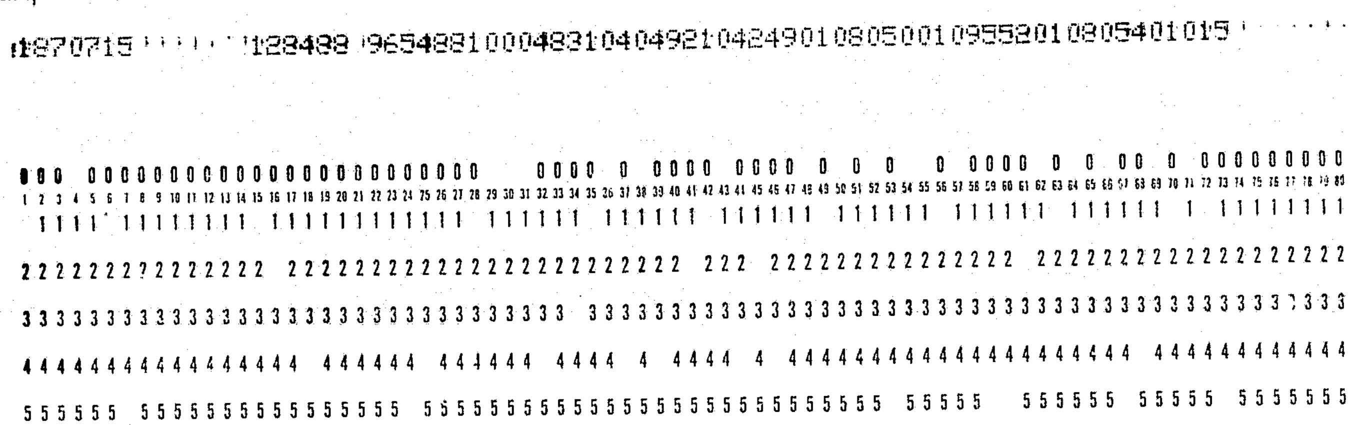
SATELLITE DATA CARD

CLOUD POLYGON CARD

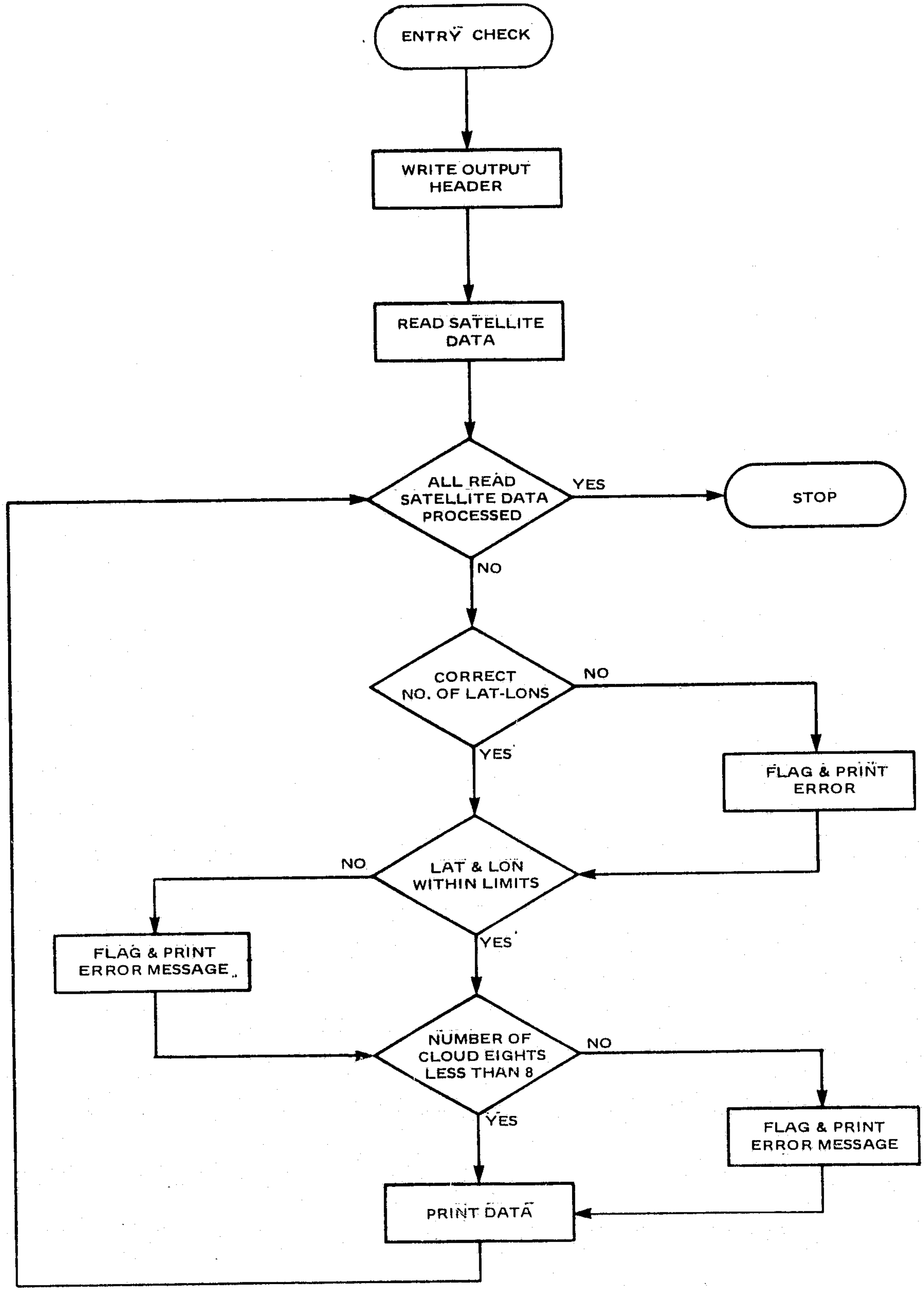
Format: (I3, I4, 10I1 (9F3.1, F4.1))

Variable	Format	Cols	Description
DAY(I)	I3	1-3	Day of the Ith Polygon
TIME(I)	I4	4-7	GMT Time of Satellite Image of Ith Polygon
CLOUD(1,I)	I1	8	8th of Cumulonimbus clouds in polygon - Visible images
CLOUD(2,I)	I1	9	8th of Nimbostratus clouds in polygon - Visible images
CLOUD(3,I)	I1	10	8th of Cumulus Congestus clouds in polygon - Visible images
CLOUD(4,I)	I1	11	8th of Stratus clouds in polygon - Visible images
CLOUD(5,I)	I1	12	8th of Stratocumulus clouds in polygon - Visible images
CLOUD(6,I)	I1	13	8th of Cumulus clouds in polygon - Visible images
CLOUD(7,I)	I1	14	8th of Cirus clouds in polygon - Visible images
CLOUD(8,I)	I1	15	8th of Brightest area in IR Image
CLOUD(9,I)	I1	16	8th of Bright area in IR Image
K(I)	I1	17	Number of Polygon Vertices
LAT(1,I)	F3.1	18-20	Latitude of First Polygon Corner
XLO(1) LON(1,I)	F4.1	21-24	Longitude of First Polygon Corner
to XLA(K) LAT(K,I)F3.1 XLO(K) LAT(K,I)F4.1		25-80	Latitude and Longitude of Nth Polygon Corner

Sample Card



4.1.1.5 FLOWCHART CHECK



4.1.1.6 SOURCE CODE

```
      INTEGER*2 STAR(300),DAY(300),TIME(300),CLOUD(300,9),K(300)  ,ICT
      REAL*4 LAT(300,9),LON(300,9)
      N=1
      KKK=0
      WRITE(6,110)
  110 FORMAT(1H1,2X,'DAY',2X,'TIME',1X,'CB',1X,'NS',1X,'CC',1X,'ST',
     * 1X,'SC',1X,'CU',1X,'CI',1X,'VB',1X,'RT',2X,'K',3X,'LAT',1X,
     * 'LON',2X,'LAT',1X,'LON',2X,'LAT',1X,
     * 'LON',2X,'LAT',1X,'LON',2X,'LAT',1X,
     * 'LON',2X,'LAT',1X,'LON',2X,'LAT',1X,
     * 'LON',2X,'LAT',1X,'LON',2X,'LAT',1X,'LON')
   10 READ(5,120,END=20) DAY(N),TIME(N),(CLOUD(N,I),I=1,9),K(N),
     *  (LAT(N,I),LON(N,I),I=1,9)
      N=N+1
      GO TO 10
  120 FORMAT(I3,I4,10I1,9(F3.1,F4.1))
   20 N=N-1
      DO 30 I=1,N
      STAR(I)=0
      KKK=KKK+1
      IF (KKK.NE. 29) GO TO 40
      KKK=0
      WRITE(6,110)
   40 DO 80 J=1,9
      IF (LAT(I,J) .EQ.0.0) GO TO 90
   80 CONTINUE
   90 IF(J .LT.9) J=J-1
      IF(LAT(I,9) .EQ. 0.0 .AND. J .EQ. 9) J=8
      IF(K(I) .EQ. J) GO TO 50
      STAR(I)=99
      WRITE (6,230)
  230 FORMAT(1X,'ERROR IN K')
   50 DO 180 KK=1,J
      IF (LAT(I,KK).LT. 37. .OR. LAT(I,KK).GT. 56.) GO TO 185
      IF (LON(I,KK).LT. 91. .OR. LON(I,KK).GT. 115.) GO TO 185
  180 CONTINUE
      GO TO 270
  185 STAR(I)=99
      WRITE(6,240)
  240 FORMAT(1X,'LAT OR LON EXCEEDS LIMITS')
  270 ICT=0
      DO 46 LL=1,9
      ICT=ICT+CLOUD(I,LL)
   46 CONTINUE
      IF(ICT.GT.8) GO TO 195
      GO TO 190
  195 WRITE(6,250)
      STAR(I)=99
  250 FORMAT(1X,'ERROR IN CLOUD SUMS')
  190 WRITE(6,130) DAY(I),TIME(I),(CLOUD(I,J),J=1,9),K(I),
```

```
     * (LAT(I,J),LON(I,J),J=1,9),STAR(I)
 130 FORMAT(3X,I3,2X,I4,9(2X,I1),2X,I1,2X,9(1X,F3.0,1X,F4.0),1X,I2/)
  30 CONTINUE
     END
```

4.1.1.7 CHECK SAMPLE OUTPUT

DAY	TIME	CB	NS	CC	ST	SC	CU	CI	VB	BT	K	LAT	LON	LAT	LON	LAT	LON	LAT	LON	LAT	LON	LAT	LON	LAT	LON	LAT	LON	LAT	LON	
234	45	0	0	0	0	0	0	0	5	1	5	48.	111.	48.	108.	46.	109.	46.	111.	48.	112.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	4	4	46.	109.	45.	108.	44.	109.	45.	110.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	5	4	44.	107.	42.	105.	40.	106.	43.	109.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	5	4	42.	105.	42.	104.	40.	104.	40.	106.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	5	0	5	43.	103.	41.	103.	41.	104.	42.	104.	43.	104.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	6	0	4	42.	100.	42.	100.	41.	102.	42.	102.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	5	4	44.	100.	43.	100.	42.	102.	43.	102.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	8	0	4	45.	94.	43.	93.	42.	97.	43.	97.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	8	0	3	45.	103.	45.	102.	42.	105.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	5	7	46.	106.	46.	104.	46.	104.	46.	103.	45.	103.	44.	104.	45.	106.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	8	0	4	47.	102.	46.	103.	46.	105.	47.	104.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	6	4	50.	97.	49.	96.	48.	99.	49.	100.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	2	4	41.	104.	41.	102.	39.	102.	39.	104.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	45	0	0	0	0	0	0	0	0	0	4	40.	97.	40.	96.	39.	96.	39.	97.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	2	6	7	50.	109.	49.	110.	49.	111.	48.	111.	48.	110.	46.	111.	49.	113.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	0	3	4	46.	109.	45.	107.	44.	109.	45.	110.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	0	2	3	45.	107.	42.	108.	44.	109.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	3	5	4	43.	102.	41.	102.	41.	104.	42.	103.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	0	5	3	42.	101.	41.	100.	41.	102.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	8	0	4	44.	100.	43.	101.	42.	103.	44.	102.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	8	0	4	46.	94.	43.	93.	41.	100.	43.	100.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	6	1	4	52.	102.	49.	106.	49.	109.	50.	109.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	5	2	9	50.	105.	48.	105.	48.	106.	47.	108.	47.	110.	48.	110.	48.	108.	49.	108.	49.	106.	0
234	645	0	0	0	0	0	0	0	8	0	4	48.	102.	48.	101.	47.	101.	48.	102.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	1	1	4	41.	104.	41.	102.	39.	102.	39.	104.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	645	0	0	0	0	0	0	0	0	0	4	40.	97.	40.	96.	39.	96.	39.	97.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	1445	0	0	0	0	7	0	0	0	0	3	50.	111.	46.	112.	49.	113.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0
234	1445	0	3	0	0	0	0	0	0	0	6	49.	109.	48.	109.	46.	111.	47.	112.	49.	111.	48.	110.	0.	0.	0.	0.	0.	0.	0

4.2 Deck Structure Edit

4.2.1 GONOGO

4.2.1.1 Functional Description

The program GONOGO performs the following operations:

1) checks data deck structure and flags structural errors;

2) produces a coherent listing of data for manual editing.

4.2.1.2 Mathematical Description

- none -

4.2.1.3 GONOGO EXECUTION

Job Control Language

```
//GONOG3 JOB (BT9001,746),HEITKEMPER,CLASS=F
//ST1 EXEC FORTGCLG,TIME.GO=05,REGION.GO=100K
//FORT.SYSIN DD *
```

- Source Deck -

```
//GO.FT10F001 DD SYSOUT=A,DCB=(RECFM=FB,LRECL=132,BLKSIZE=1320)
//GO.SYSIN DD *
  Unit 5 data deck
/*
//
```

Data Definition Description

```
FT05F001  -  Input data cards
FT06F001  -  Printer output
FT10F001  -  Printer output
```

4.2.1.4 DATA DESCRIPTION

INPUT DATA CARDS FOR GONOGO PROGRAM

1. SEQUENCE

Card	Number	Card name
STATION ORDER VECTOR	2 CARDS	EXPECTED STATION ORDER CARD
START - END DAYS	1 CARD	TIME INTERVAL CARD
6 hr INTERVAL VECTOR	1 CARD	6 hr INTERVAL CONTROL CARD
READ C1...C10 COEFF. FOR RAINFALL EQUATION	1 CARD	RAIN COEFFICIENT CARD
BOUNDARIES OF ANALYSIS AREA ETC.	1 CARD	AREA BOUNDARY CARD
6 HR INTERVAL DAY, TIME,...ETC. 06 GMT	1 CARD	TIME INTERVAL CONTROL CARD
SAT CLOUD COVER FOR 6HR INTERVAL 0-06 GMT	1 CARD PER POLYGON	CLOUD POLYGON CARD
K=0 in column 17	1 CARD ENDS 6HR INTERVAL	END CLOUD POLYGON CARD
STATION DATA FOR 06 GMT	1 CARD PER STATION 34 CARDS	STATION DATA CARD

FOR 06-12-18-24 GMT PER EACH DAY

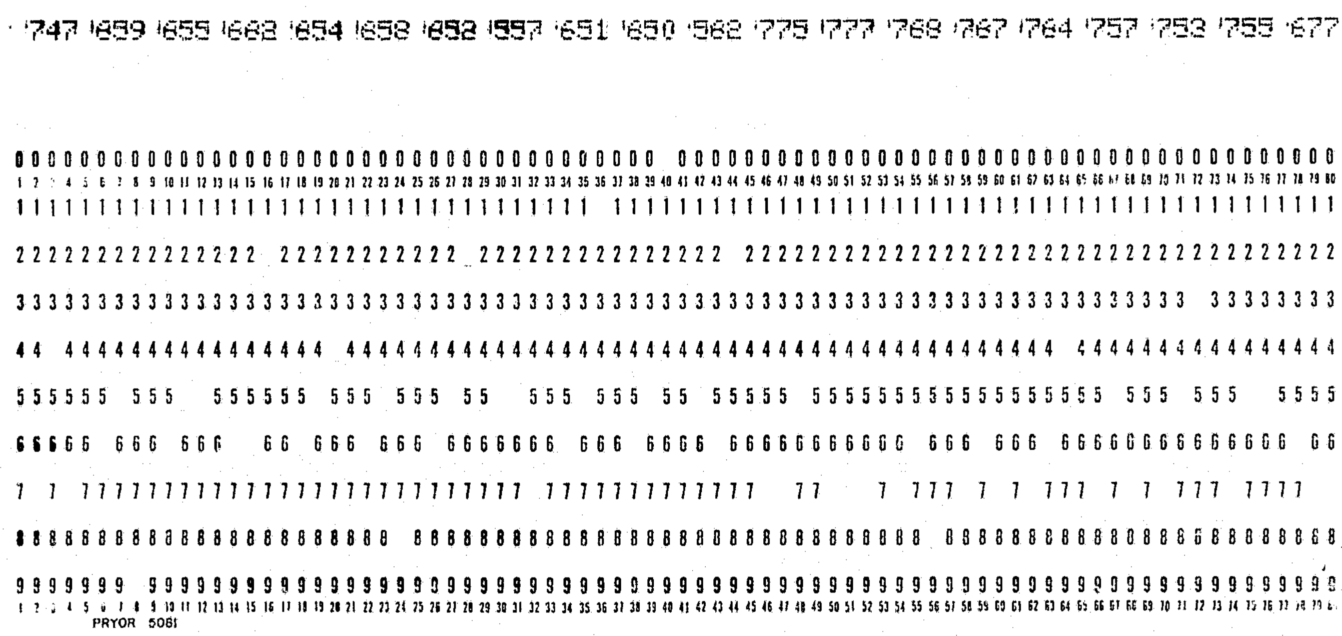
STATION ORDER DATA CARD

FORMAT: (20(1X,I3)/14(1X,I3))

Note: Format requires two data cards

Variable	Format	Cols	Description
IHOLD(1)	I3	2-4	Station Number of Station I
	1x,I3)	5-80	
.			
.			
.	Card 2		
IHOLD(34)	I3	1-56	Station Number

SAMPLE CARD:

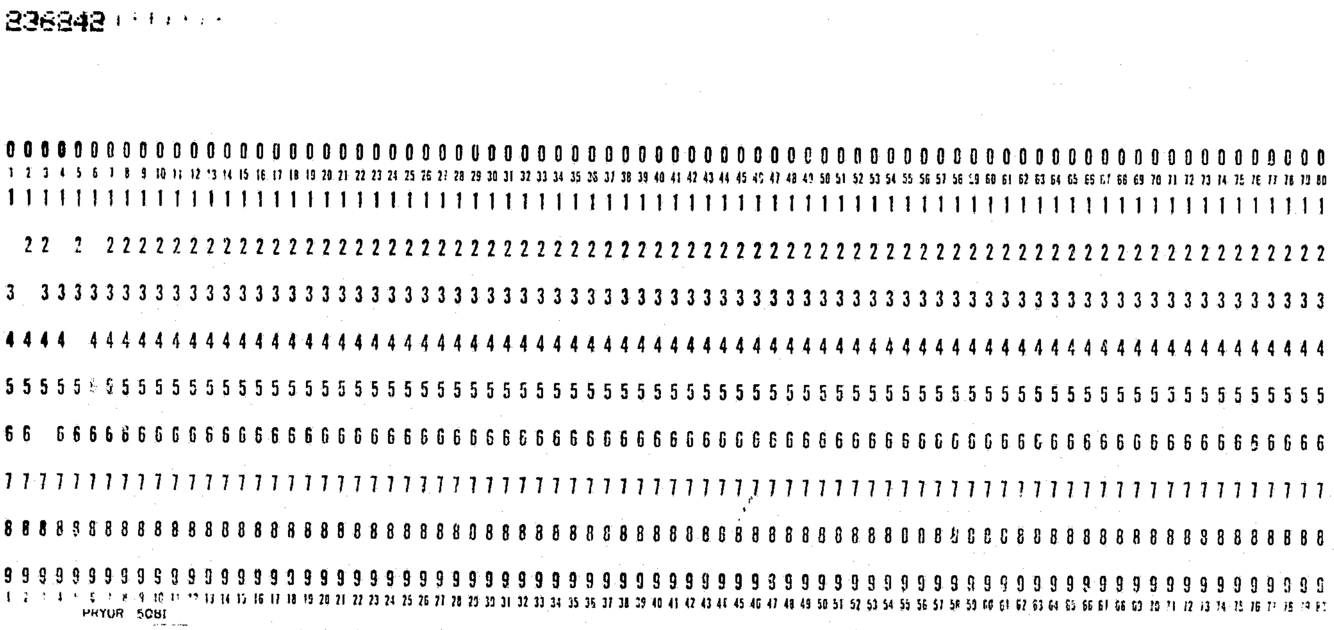


TIME INTERVAL DATA CARD

FORMAT: (2I3)

Variable	Format	Cols	Description
ISTART	I3	1-3	Processing Start Day
IEND	I3	4-6	Processing End Day

SAMPLE CARD:

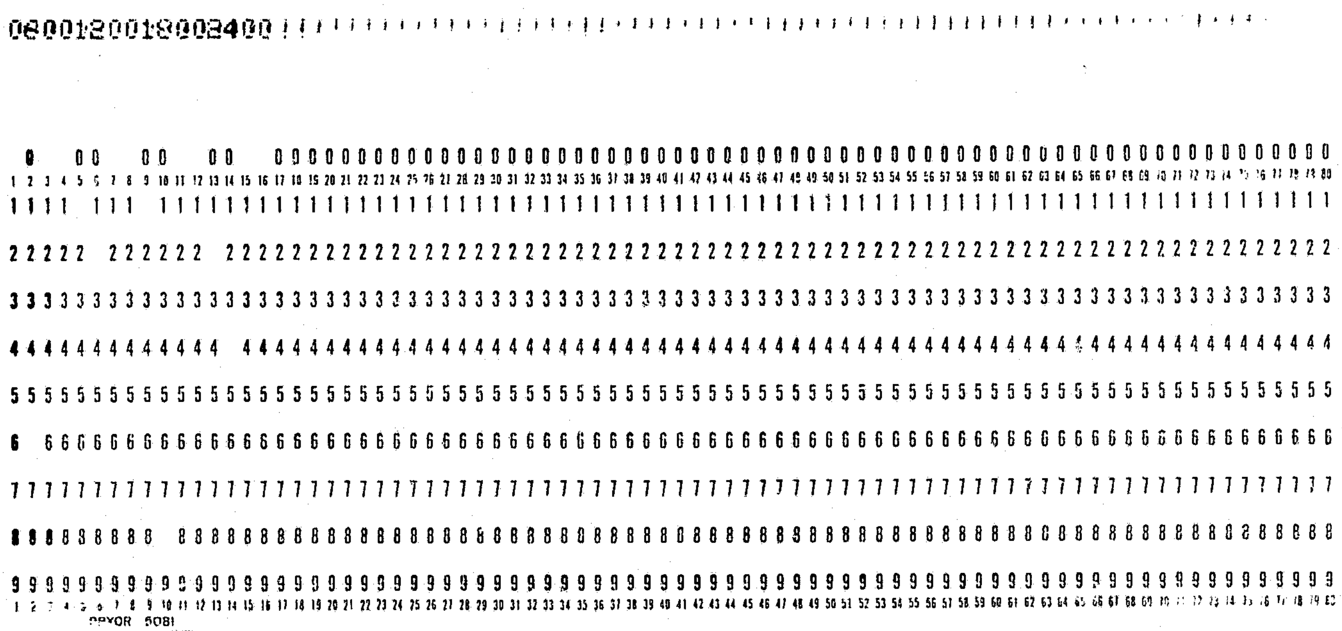


6-HR INTERVAL CONTROL DATA CARD

FORMAT: (4I4)

Variable	Format	Cols	Description
ICHECK(1)	I4	1-4	GMT hour 06
ICHECK(2)	I4	5-8	GMT hour 12
ICHECK(3)	I4	9-12	GMT hour 18
ICHECK(4)	I4	13-16	GMT hour 24

SAMPLE CARD:



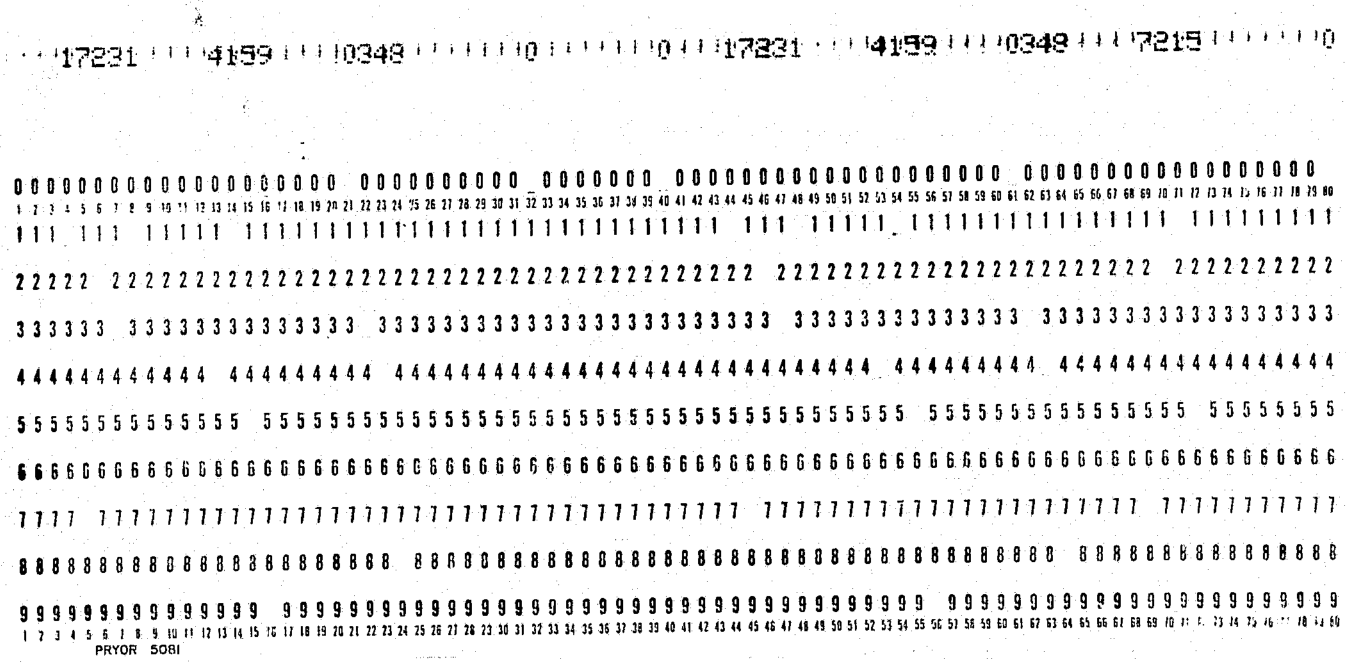
C-2

RAIN COEFFICIENTS CARD

Format: (10F8.4)

Variable	Format	Cols	Description
C(1)	F8.4	1-8	
C(2)	F8.4	9-16	
C(3)	F8.4	17-24	
C(4)	F8.4	25-32	Rain coefficients for satellite
C(5)	F8.4	33-40	rain equation
C(6)	F8.4	41-48	
C(7)	F8.4	49-56	
C(8)	F8.4	57-64	
C(9)	F8.4	65-72	
C(10)	F8.4	73-80	

Sample Card

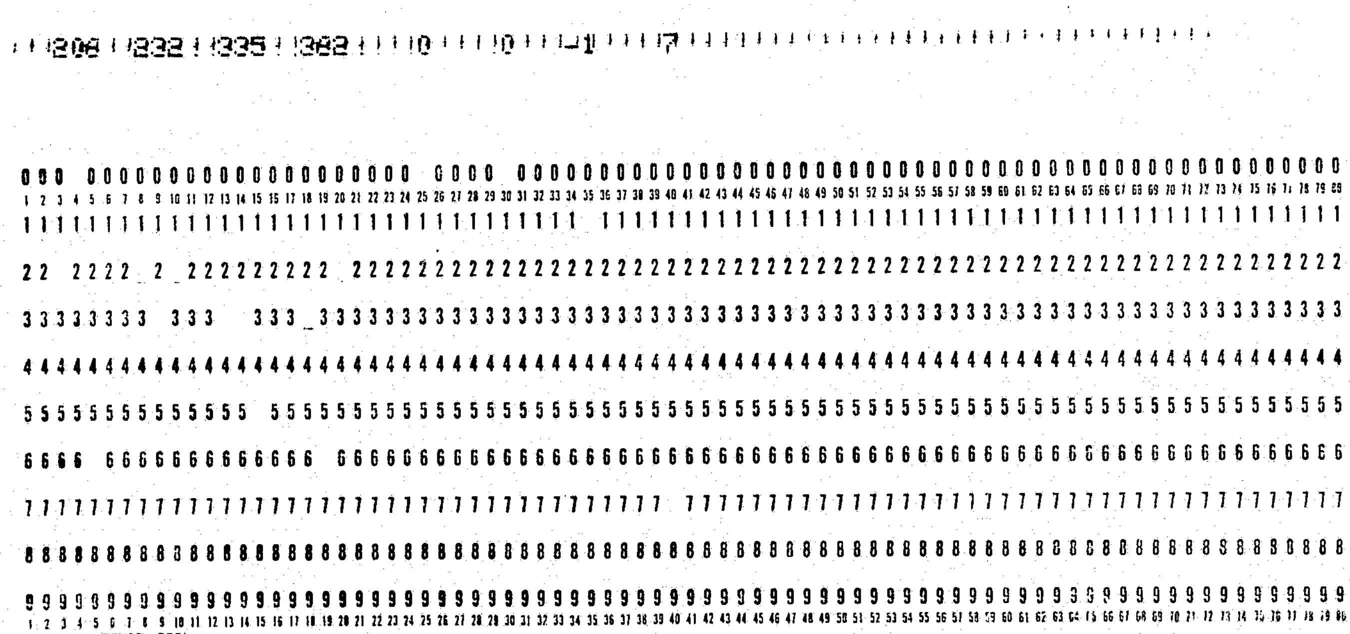


AREA BOUNDARY CARD - PROCESSING PERIOD

Format: (8I5)

Variable	Format	Cols	Description
IFIRST	I5	1-5	
ILAST	I5	6-10	Limits of I, J Area
JFIRST	I5	11-15	
JLAST	I5	16-20	
IDIS	I5	21-25	0
JDIS	I5	26-30	0
IEAST	I5	31-35	(-1) West, (+1) East Longitude
NDAYS	I5	36-40	Days to Process

Sample Card

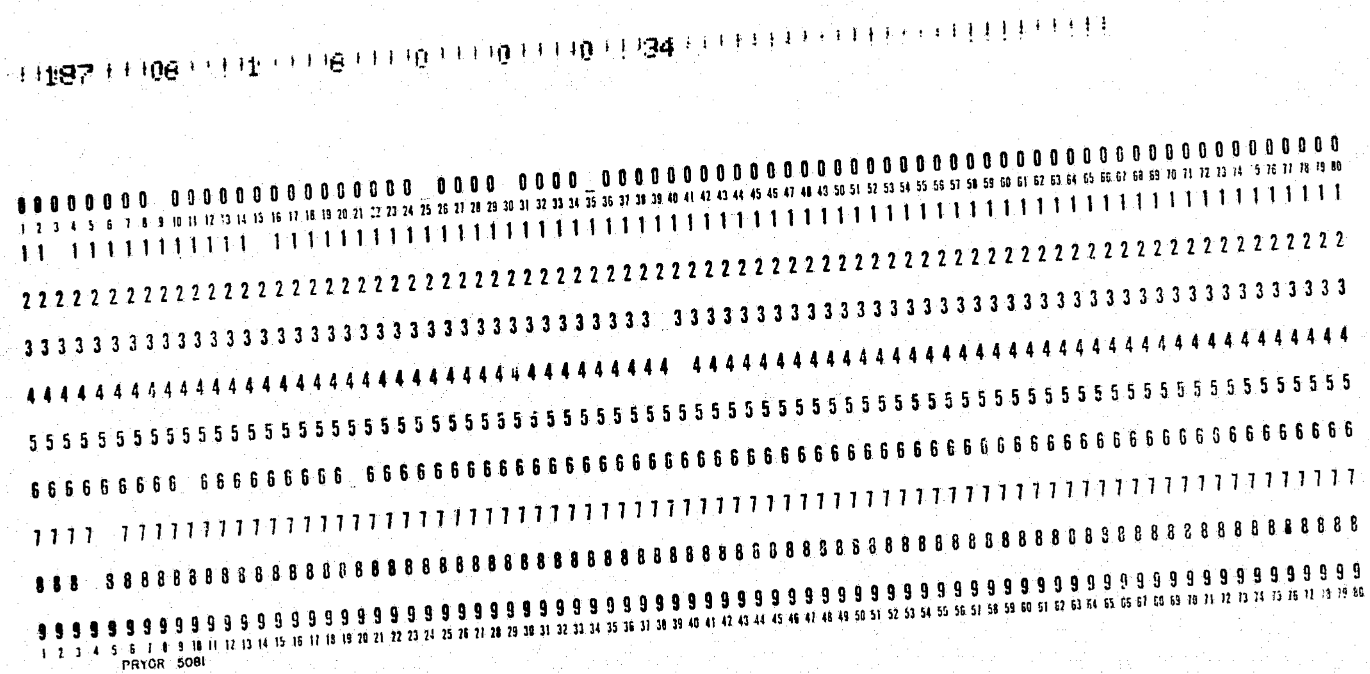


TIME INTERVAL CONTROL CARD

Format: (8I5,2F10.3)

Variable	Format	Cols	Description
IDAY	1-5	I5	Julian Day
ITIME	6-10	I5	GMT Time
KI	11-15	I5	(1) Freq of ground obs in 6Hr interval
IDEL2	16-20	I5	Verification Variable
IRNO	21-25	I5	Switch for IR SAT Images 1=yes 0=no
IVNO	26-30	I5	Switch for Vis Sat Images 1=yes 0=no
ITEST	31-35	I5	Satellite Image Indicator
NSTA	36-40	I5	Number of Stations

Sample Card



CLOUD POLYGON CARD

Format: (I3, I4, 10I1 (9F3.1, F4.1))

Variable	Format	Cols	Description
ID	I3	1-3	Day
IT	I4	4-7	GMT Time of Satellite Image
ICC(1)	I1	8	8th of Cumulonimbus clouds in polygon - Visible images
ICC(2)	I1	9	8th of Nimbostratus clouds in polygon - Visible images
ICC(30)	I1	10	8th of Cumulus Congestus clouds in polygon - Visible images
ICC(4)	I1	11	8th of Stratus clouds in polygon - Visible images
ICC(5)	I1	12	8th of Stratocumulus clouds in polygon - Visible images
ICC(6)	I1	13	8th of Cumulus clouds in polygon - Visible images
ICC(7)	I1	14	8th of Cirus clouds in polygon - Visible images
ICC(8)	I1	15	8th of Brightest area in IR Image
ICC(9)	I1	16	8th of Bright area in IR Image
K	I1	17	Number of Polygon Vertices
XLA(1)	F3.1	18-20	Latitude of First Polygon Corner
XLO(1)	F4.1	21-24	Longitude of First Polygon Corner
to XLA(K) XLO(K)	F3.1 F4.1	25-80	Latitude and Longitude of Nth Polygon Corner

Sample Card

1870715 128488 9654881000483104049210424901080500109552010805401015

STATION - DATA CARD

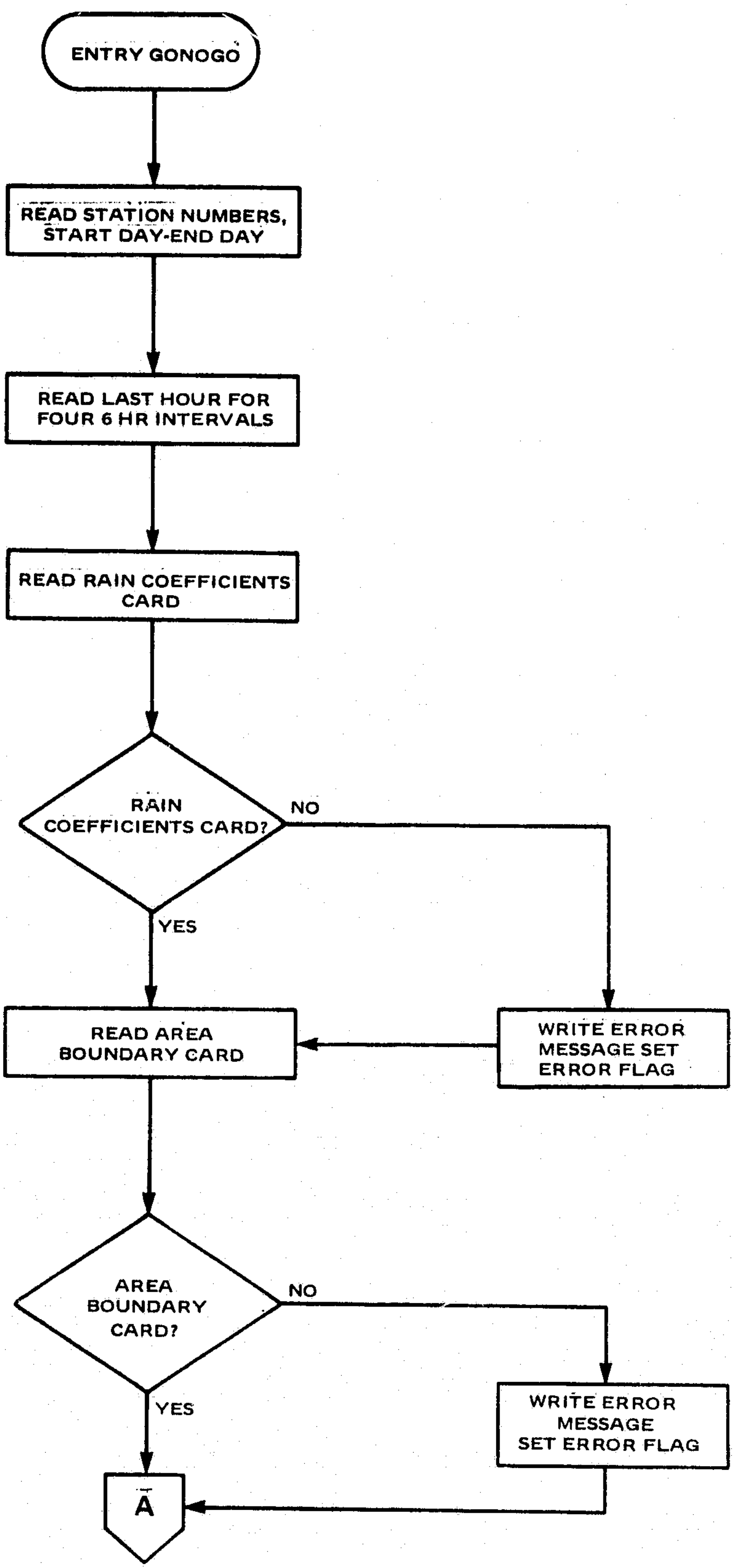
Format: (I3, I6, 2I3, 2X, I2, I3, 3I2, 2X, I2, 3X, I1, I2, I1, 2X, I1, I4, 2X, I1, I4, 2X, I1, 2I2)

Variable	Format	Cols	Description
ISTA(I)	I3	1-3	Station Number for Ith Station
NTIME	I6	4-9	Packed Month - Day - Hour
IVAR(1)	I3	10-12	Total Cloud
IVAR(2)	I3	13-15	Wind Speed Knots
IVAR(3)	I2	18-19	Temperature
IVAR(4)	I3	20-22	Amount of Low or Middle Cloud
IVAR(5)	I2	23-24	Amount Low Cloud
IVAR(6)	I2	25-26	Amount Middle Cloud
IVAR(7)	I2	27-28	Amount High Cloud
IVAR(8)	I2	31-32	Dew Point
IVAR(9)	I1	36	Previous 6HR Rainfall Switch
IVAR(10)	I2	37-38	Previous 6HR Rainfall in Hundreths
IVAR(11)	I1	39	Inches Rainfall in Previous 6HR
IVAR(12)	I1	42	Special Phenomena Switch
IVAR(13)	I4	43-46	Special Phenomena Identification
IVAR(14)	I1	49	Previous 24 hr. Rainfall Switch
IVAR(15)	I4	50-53	24 Hour Rainfall Amount in Hundreths
IVAR(16)	I1	56	Temperature Data Switch
IVAR(17)	I2	57-58	Maximum 6Hr Temperature
IVAR(18)	I2	59-60	Minimum 6Hr Temperature

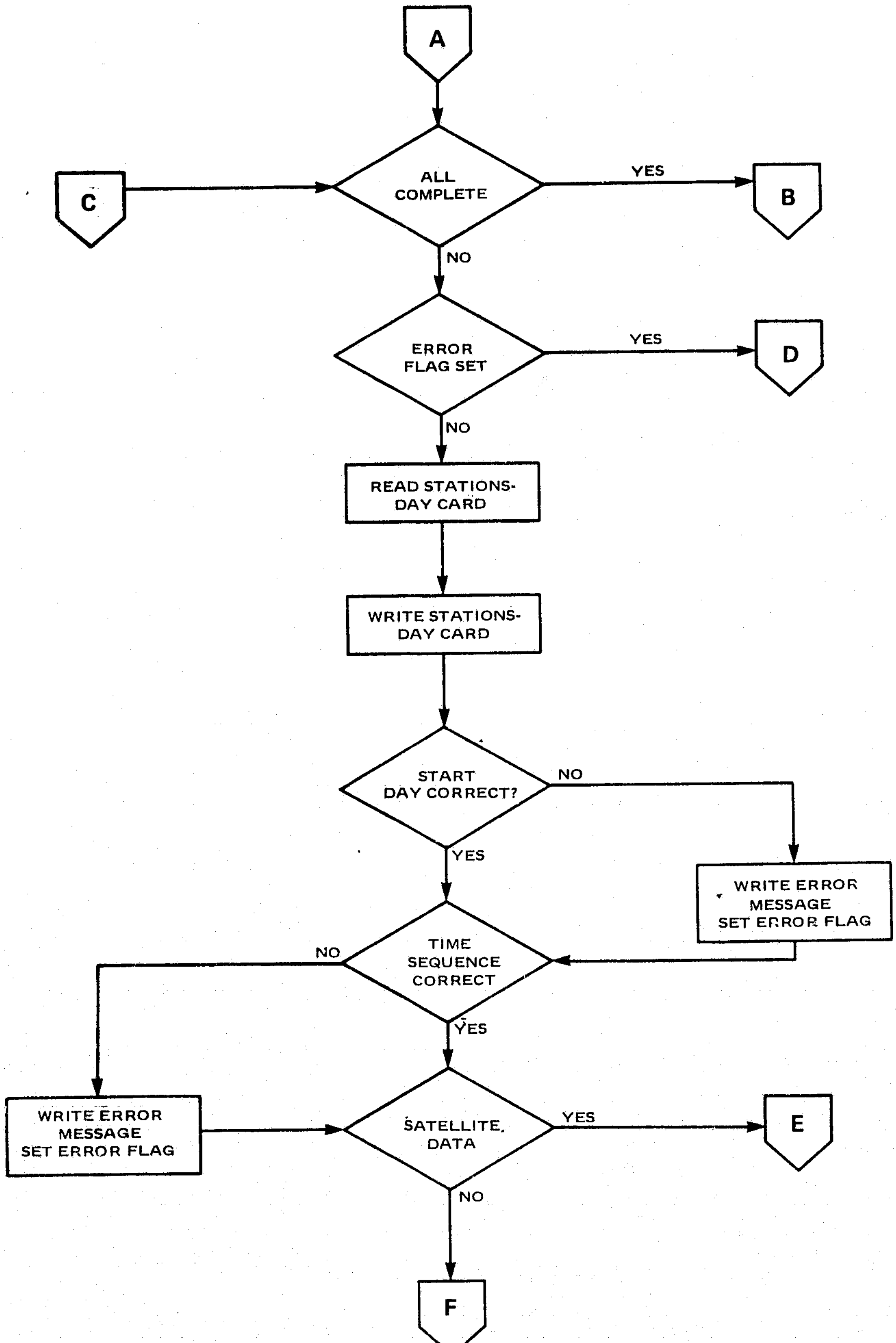
Sample Data Card

767 70812 8 08 19 8 9-1-1 19 710 20010 49264

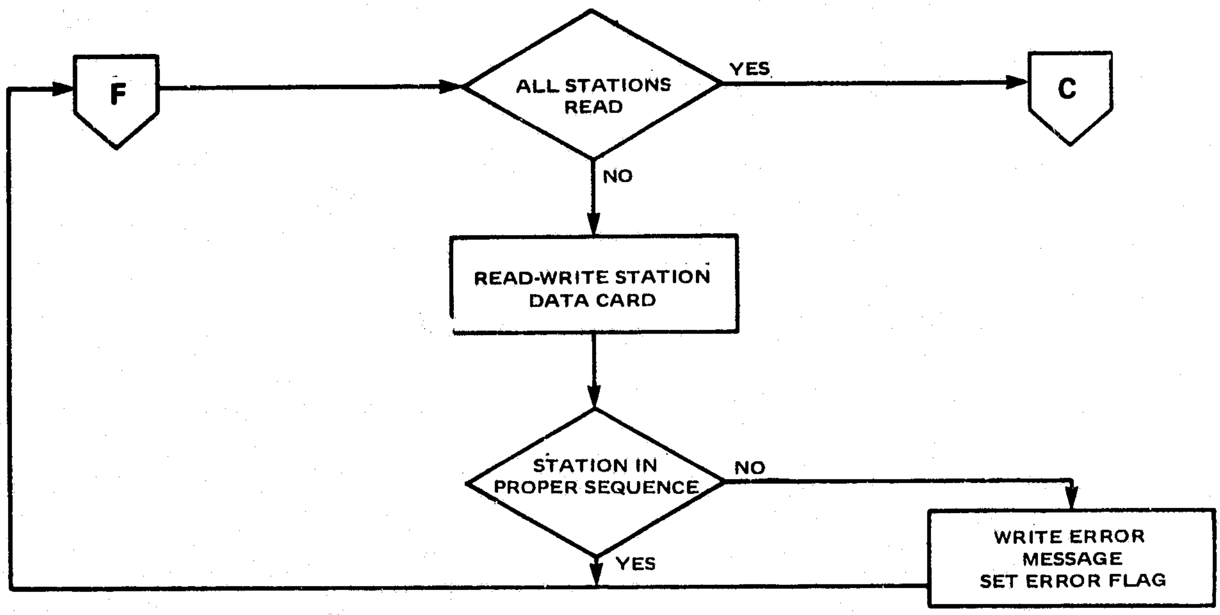
4.2.1.5 FLOWCHART GONOGO

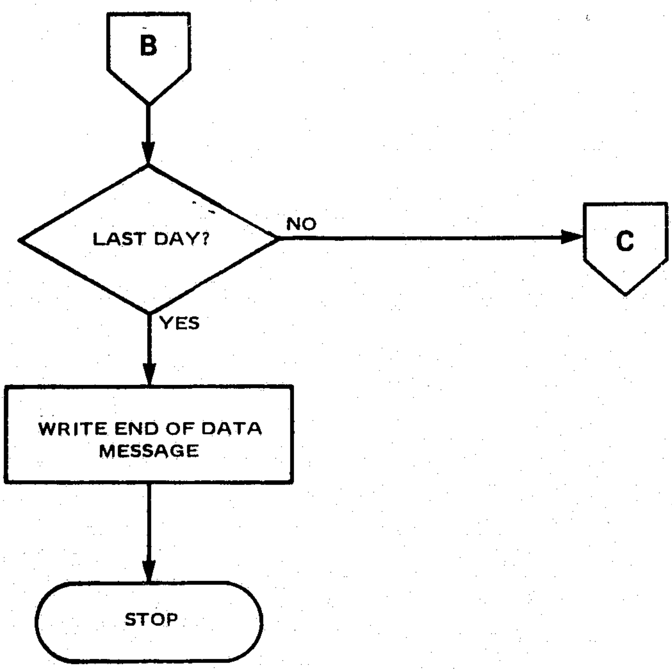


GONOGO

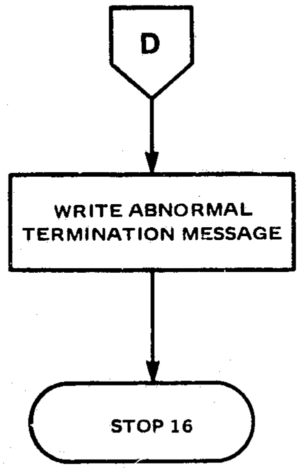

A
ALL COMPLETE
YES
B
C
NO
ERROR FLAG SET
YES
D
NO
READ STATIONS-DAY CARD
WRITE STATIONS-DAY CARD
START DAY CORRECT?
NO
YES
WRITE ERROR MESSAGE SET ERROR FLAG
TIME SEQUENCE CORRECT
NO
YES
WRITE ERROR MESSAGE SET ERROR FLAG
SATELLITE DATA
YES
E
NO
F

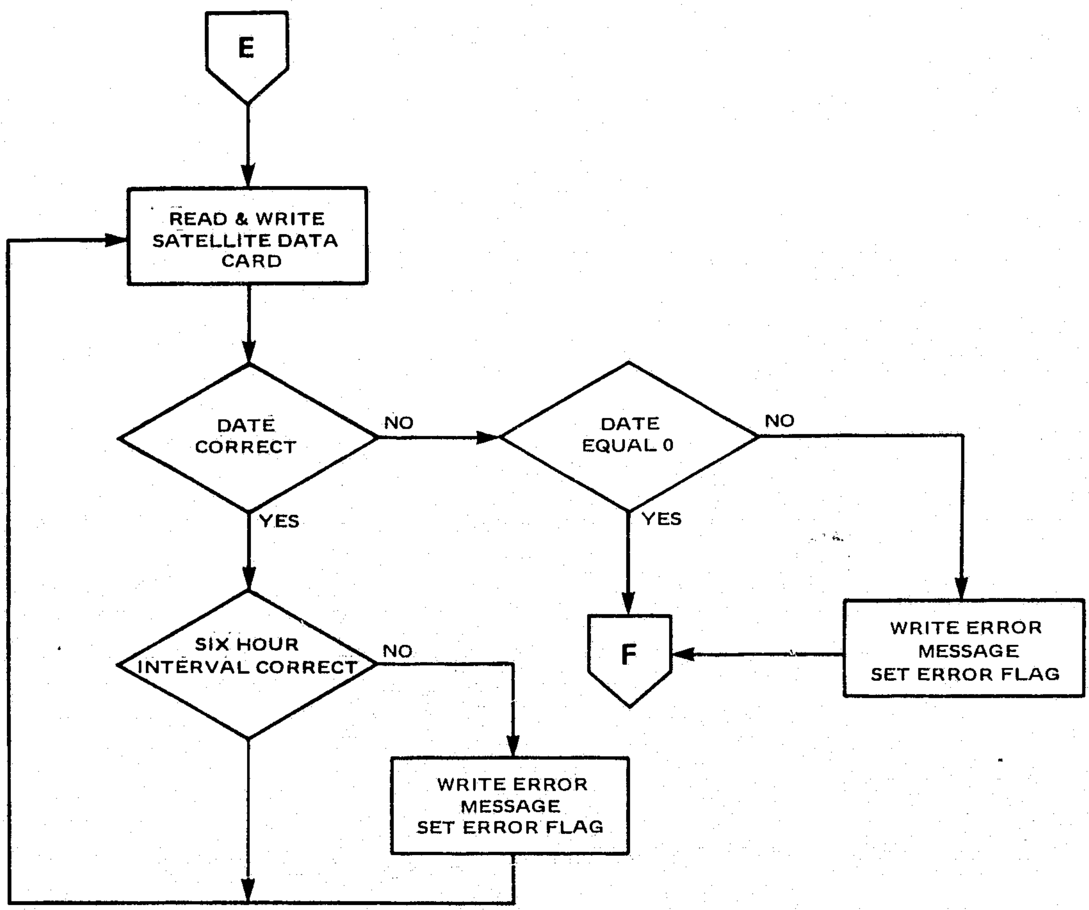
GONOGO


F
ALL STATIONS READ
YES
C
NO
READ-WRITE STATION DATA CARD
STATION IN PROPER SEQUENCE
NO
WRITE ERROR MESSAGE SET ERROR FLAG
YES


B
LAST DAY?
NO
C
YES
WRITE END OF DATA MESSAGE
STOP

GONOGO


D
WRITE ABNORMAL TERMINATION MESSAGE
STOP 16


E
READ & WRITE SATELLITE DATA CARD
DATE CORRECT
NO
YES
DATE EQUAL 0
NO
YES
SIX HOUR INTERVAL CORRECT
NO
F
WRITE ERROR MESSAGE SET ERROR FLAG
WRITE ERROR MESSAGE SET ERROR FLAG

4.2.1.6 SOURCE CODE

```
      INTEGER*2  IHOLD(34),ICHECK(4),ISTA(34),ICC(9),IVAR(18)
      REAL*4 C(10),XLA(9),XLO(9)
      N=0
      NN=1
      IUNIT=10
      READ(5,100) (IHOLD(I),I=1,34)
100   FORMAT(20(1X,I3)/14(1X,I3))
      READ(5,110) ISTART,IEND
110   FORMAT(2I3)
      READ(5,115) (ICHECK(I),I=1,4)
115   FORMAT(4I4)
      READ(5,120) (C(I),I=1,10)
120   FORMAT(10F8.4)
      WRITE(IUNIT,120)     (C(I),I=1,10)
      IF(C(1).LT.0.0.OR.C(1).GT.3.0) GO TO 91
14    READ(5,130) IFIRST,ILAST,JFIRST,JLAST,IDIS,JDIS,IEAST,NDAYS
130   FORMAT(8I5)
      WRITE(IUNIT,130) IFIRST,ILAST,JFIRST,JLAST,IDIS,JDIS,IEAST,NDAYS
      IF(IFIRST.NE.206) GO TO 92
      GO TO 12
91    WRITE(6,240)
      N=N+1
240   FORMAT(1X,'ERROR ON RAIN COEFFICIENTS')
      GO TO 14
92    WRITE(6,250)
      N=N+1
250   FORMAT(1X,'ERROR ON AREA BOUNDARY CARD')
12    DO 1 KK=1,4
      IF(N.NE.0) GO TO 400
      READ(5,140) IDAY,ITIME,K1,IDEL2,IRNO,IVNO,ITEST,NSTA
140   FORMAT(8I5)
      WRITE(IUNIT,140) IDAY,ITIME,K1,IDEL2,IRNO,IVNO,ITEST,NSTA
      IF(IDAY.NE.ISTART) GO TO 93
      IT2=ITIME*100
  15  IF (IT2 .NE. ICHECK(KK)) GO TO 94
 26   IF(ITEST.EQ.0) GO TO 2
6     READ(5,150) ID,IT,(ICC(J),J=1,9),K,(XLA(LK),XLO(LK),LK=1,K)
150   FORMAT(I3,I4,10I1,9(F3.1,F4.1))
      WRITE(IUNIT,350) ID,IT,(ICC(J),J=1,9),K,(XLA(LK),XLO(LK),LK=1,K)
 350  FORMAT(I3,I4,1X,9I1,1X,I1,1X,9(F4.1,1X,F5.1,1X))
      IF(ID.NE.ISTART) GO TO 8
      IF(KK.EQ.1) GO TO 4
      IF(IT.GT.ICHECK(KK).OR.IT.LT.ICHECK(KK-1)) GO TO 95
      GO TO 6
4     IF(IT.GT.ICHECK(KK).OR.IT.LT.0) GO TO 95
      GO TO 6
8     IF(ID.NE.0) GO TO 16
      NN=1
      GO TO 2
  16  IF (ID .EQ. 747) GO TO 96
      GO TO 400
```

```
93    WRITE(6,200) IDAY,ITIME
200   FORMAT(1X,'ERROR WITH TIME INTERVAL CARD AT',2I5)
      N=N+1
      GO TO 15
94    WRITE(6,210)
210   FORMAT(1X,'TIME INTERVAL CARD OUT OF ORDER')
      N=N+1
      GO TO 26
95    WRITE(6,220) ID,IT
220   FORMAT(1X,'POLYGON CARD PROBLEM AT',I3,I4)
      N=N+1
      GO TO 6
96    WRITE(6,330) ID,IT
330   FORMAT(1X,'BLANK CARD MISSING AT',I3,I4)
      N=N+1
      NN=2
2     DO 9 I=NN,34
      READ(5,160) ISTA(I),NTIME,(IVAR(II),II=1,18)
160   FORMAT(I3,I6,2I3,I4,I3,3I2,I4,I4,I2,I1,I3,I4,I3,I4,I3,2I2)
      WRITE(IUNIT,160) ISTA(I),NTIME,(IVAR(II),II=1,18)
      IF(ISTA(I).NE.IHOLD(I)) GO TO 97
      GO TO 9
97    WRITE(6,230) ISTA(I),NTIME
      N=N+1
230   FORMAT(1X,'ERROR ON STATION CARD',I4,I6)
9     CONTINUE
1     CONTINUE
   18 IF(ISTART.EQ.IEND) GO TO 98
      ISTART=ISTART+1
      GO TO 12
98    WRITE(6,260)
260   FORMAT(1X,'PROGRAM HAS REACHED END OF DATA')
      GO TO 300
400   WRITE(6,280) ID,IT
280   FORMAT(1X,'PROGRAM WENT FUBAR AT',I3,I4)
      N=N+1
  300 IF (N .NE. 0) STOP 16
      END
```

4.2.1.5 GONOGO SAMPLE OUTPUT

```
  0.7369  0.1779  0.0150  0.0      0.0      0.7369  0.1779  0.0150  0.2411  0.0
  206  232  335  362    0    0   -1    7
  208    6    1    6    1    0    1   34
208  45 000000002 4 51.5  98.9 47.7 100.3 49.0 104.7 51.5 104.8
208  45 000000001 4 51.0 104.9 50.2 105.5 51.5 106.8 52.0 105.3
208  45 000000013 4 42.5  95.5 41.8  98.0 42.8 103.9 44.3 102.0
208  45 000000042 4 41.9  97.7 40.2 103.9 41.2 105.9 42.9 103.8
208  45 000000042 4 44.0 101.9 40.7 106.0 42.5 108.2 44.9 103.2
208  45 000000060 3 40.1 105.0 40.0 106.0 42.5 108.0
208  45 000000013 4 43.9 105.2 42.2 108.1 45.5 110.7 45.4 106.8
208  45 000000002 4 41.0 104.0 41.0 102.0 39.0 102.0 39.0 104.0
208  45 000000012 4 40.0  97.0 40.0  96.0 39.0  96.0 39.0  97.0
  0   0 000000000 0  0.0    0.0
747 72706  0  7  16  0 0 0 0  12   0 00  0   0  2  27  48160
659 72706  0  4  19  0 0 0 0  14   0 00  0   0  0   0  49366
655     0  0  0   0  0 0 0 0   0   0 00  0   0  0   0  0 0 0
662 72706  1  0  23  1 5 0 0   8   0 00  0   0  2   0  49667
654 72706  0  3  20  0 0 0 0  13   0 00  0   0  0   0  49867
658 72706  0  3  23  0 0 0 0  14   0 00  0   0  0   0  49066
652 72706  2  0  24  2 0 3 0  15   0 00  0   0  0   0  4 268
557 72706  1  7  24  1 0 7 0  21   0 00  0   0  0   0  49263
651 72706  0  4  19  0 0 0 0  16   0 00  0   0  0   0  4 367
650 72706  0  0  19  0 0 0 0  11   0 00  0   0  0   0  48960
562     0  0  0   0  0 0 0 0   0   0 00  0   0  0   0  0 0 0
775 72706  0  5  23  0 0 0 0   6   0 00  0   0  2   0  49557
777     0  0  0   0  0 0 0 0   0   0 00  0   0  0   0  0 0 0
768 72706  0 10  21  0 0 0 0   8   0 00  0   0  0   0  49061
767 72706  0  0  17  0 0 0 0  11   0 00  0   0  0   0  48658
764 72706  0  0  18  0 0 0 0  12   0 00  0   0  2   0  48960
757     0  0  0   0  0 0 0 0   0   0 00  0   0  0   0  0 0 0
753 72706  0  6  16  0 0 0 0  12   0 00  0   0  0   0  48561
755 72706  0  6  17  0 0 0 0  12   0 00  0   0  2  15  48461
677 72706  0  4  24  0 0 0 0   6   0 00  0   0  0   0  49563
666     0  0  0   0  0 0 0 0   0   0 00  0   0  0   0  0 0 0
851 72706  0  9  17  0 0 0 0  10   0 00  0   0  0   0  48163
852 72706  0  8  16  0 0 0 0  12   0 00  0   0  0   0  48161
862 72706  2  4  18  2 0 3 0  14   0 00  0   0  0   0  48259
863 72706  1  5  19  1 0 3 0  10   0 00  0   0  0   0  48454
870 72706  0  7  16  0 0 0 0   8   0 00  0   0  0   0  48659
872 72706  0  5  21  0 0 0 0   9   0 00  0   0  0   0  48859
874 72706  0 11  21  0 0 0 0  12   0 00  0   0  0   0  49154
564 72706  0  7  18  0 0 0 0   4   0 00  0   0  0   0  48254
465 72706  0  9  21  0 0 0 0   4   0 00  0   0  0   0  49157
458 72706  4 10  24  0 0 0 1  16   0 00  0   0  0   0  49465
456 72706  2 10  24  0 0 0 1  21   0 00  0   0  0   0  49156
446 72706  0  3  21  0 0 0 0  21   0 00  0   0  0   0  49469
469 72706  0  8  19  0 0 0 0   2   0 00  0   0  2   0  48758
  208   12    1    6    1    0    1   34
208 645 000000006 4 50.5  99.6 48.5 101.6 49.1 103.9 53.0 103.0
208 645 000000003 4 44.0  99.3 45.2 101.9 45.8 100.5 45.2  99.5
208 645 000000003 4 44.4 101.9 43.4 102.2 43.8 104.4 44.8 103.7
208 645 000000003 6 42.3  95.2 41.9  97.2 42.5  98.6 42.3  99.8 42.9 100.0 43.7  98.2
208 645 000000041 3 42.0 103.4 42.4 105.0 43.1 103.8
208 645 000000015 6 44.8 105.1 42.7 106.1 42.0 107.8 43.8 108.9 45.5 107.8 45.7 106.1
208 645 000000000 4 41.0 104.0 41.0 102.0 39.0 102.0 39.0 104.0
208 645 000000001 4 40.0  97.0 40.0  96.0 39.0  96.0 39.0  97.0
  0   0 000000000 0  0.0    0.0
747 72712  0  6  13  0 0 0 0  11   0 00  0   0  0   0  48154
659 72712  1  3  13  1 0 7 0  12   0 00  0   0  0   0  49356
655 72712  0  0  16  0 0 0 0  13   0 00  0   0  0   0  4-161
662 72712  2  0  19  1 1 7 0   9   0 00  0   0  0   0  49662
654 72712  1  0  17  1 2 8 0  12   0 00  0   0  0   0  49862
658 72712  0  3  20  0 0 0 0  14   0 00  0   0  0   0  49062
```

AGROMETEOROLOGICAL-PREDICTIVE SUBSYSTEM

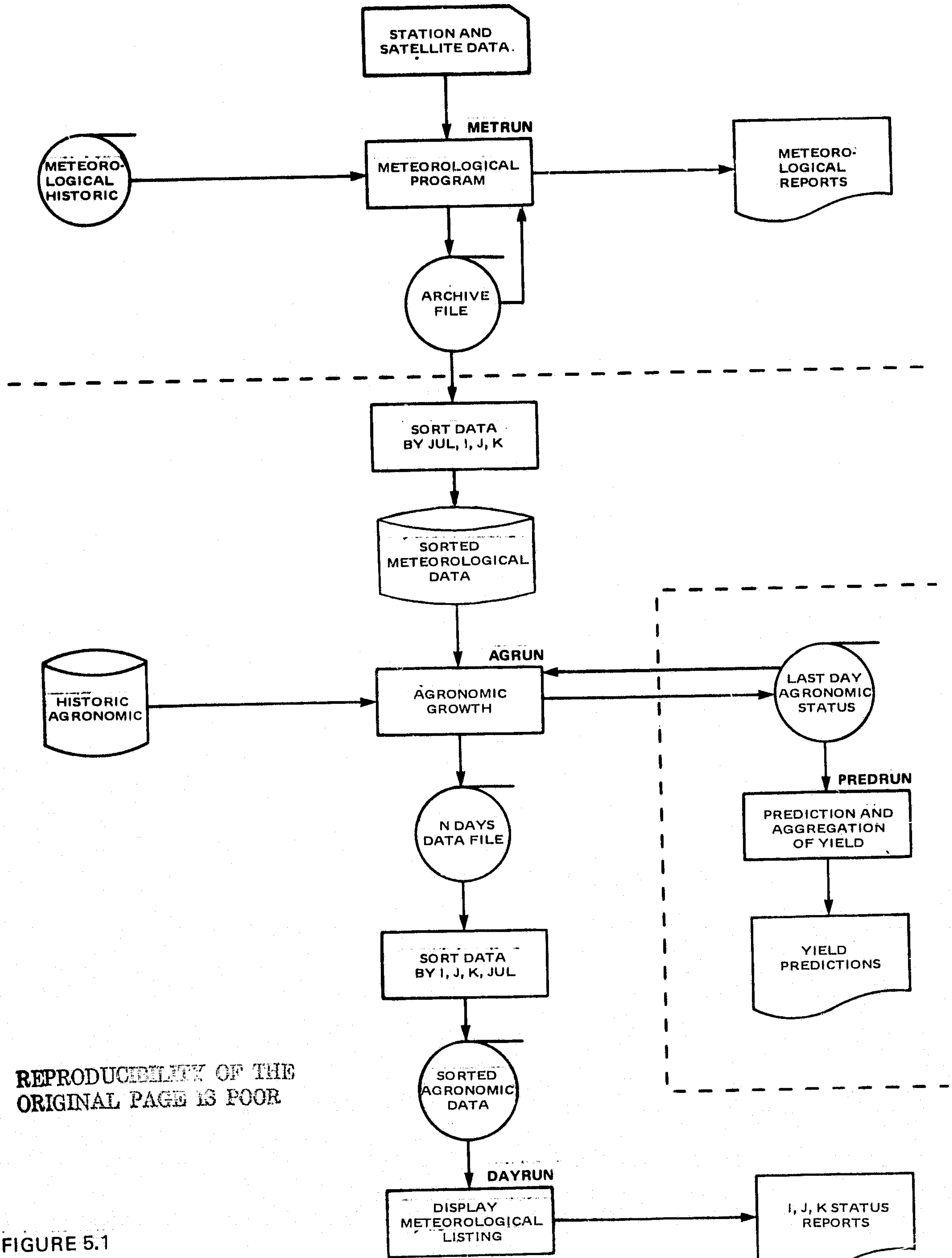


FIGURE 5.1

5.0 AGROMETEOROLOGICAL-PRED SYSTEM

The agronomic-pred system (Figure 4.1) includes the following segments:

1. Meteorological model which processes station and satellite data as well as historical data to produce plant environment data for the daily plant environment.
2. Agronomic plant growth model which grows the plant in its historical, seasonal, and daily environment, and produces daily estimate of plant stress.
3. Predict of wheat yields at i,j, county, crop reporting district, and state levels using historical trend and average plant stress.

Appendix 3 presents instructions for the composite Agrometeorological-PRED system operation as previously supplied to NOAA, CCEA Columbia, Missouri. Necessary reorganization of data from program to program (Figure 5.1) is accomplished via system supplied sorting routines and documentation supplied as part of the program execution section of the appropriate program.

5.1 Meteorological Segment

5.1.1 METRUN

5.1.1.1 Functional Description

The program METRUN performs the following operations:

1. Interpolates using inverse distance weights station data to i,j for temperature, dew point.
2. Calculates an estimate of i,j rainfall from satellite data.
3. Calculates i,j potential evapotranspiration.
4. Calculates i,j solar radiation, net radiation.

5. Prints daily meteorological values, 6-hour -24-hour - weekly precipitation.

6. Stores meteorological data in the file for agronomic growth.

Records in the file generated for the ag section are stored by day, then ascending i,j, and contain the following information:

1. i,j
2. daily precipitation
3. daily ETP
4. daily net radiation
5. daily solar radiation
6. maximum daily temperature
7. minimum daily temperature
8. BMT
9. Julian date

5.1.1.2 Mathematical Description

The following is a description of how the EARTHSAT "System" meteorological software calculates the ETP utilizing both ground observations and satellite cloud cover.

The Penman equation as used for the potential evapotranspiration calculation (Penman, 1948):

$$\text{ETP (mm/time)} = \frac{\Delta R_{NET} + 0.64\, f\,(w)(e_s - e_a)}{\Delta + 0.64} \qquad (1)$$

where

RNET is net radiation in cal/cm^2 per time interval, Δ is slope of saturation vapor pressure versus temperature curve (mb $°K^{-1}$)

e_s is saturation vapor pressure at air temperature (mb)

e_a is vapor pressure at air temperature (mb)

$f(w)$ is the wind effect, a function of the horizontal wind velocity.

The wind effect $f(w)$ is given by Penman (1956) as

$$f\,(w) = 0.35\,(0.5 + w/100) \qquad (2)$$

where w is wind movement in miles per 24 hours

In the EarthSat "System" the ETP calculations are performed for six-hour intervals at each I, J in the area. Daily ETP is obtained by summing up four six-hour calculations. For six-hour calculations the wind function becomes

$$f(w) = 0.35\,(0.5 + 0.27618\,w)/4 \qquad (3)$$

where w is a surface wind measurement, in knots, made during the six-hour interval.

e_s, e_a and Δ are calculated from six-hourly temperatures and dew point observations by means of psychometric equations presented in the Smithsonian Meteorological Tables (1966).

Temperature, dew point, and wind are interpolated for each I, J cell coordinate from the 34 meteorological stations observations by means of an inverse-distance weight function. The interpolated value at I, J, X_{ij}, is

$$X_{ij} = \sum_{S}^{n} \frac{x_n}{d_n} \Big/ \sum_{1}^{n} \frac{1}{d_n} \qquad (4)$$

where x_n represents the value of a parameter observed at station n at a distance d_n from the cell coordinates I, J. Only the nearest 3 stations (of a total of 8) are considered.

Net radiation (RNET) is the net energy gained by the surface through the processes of insolation and terrestrial radiation losses to space. RNET is a measure of how much energy is available for heating the ground, and most importantly, for evaporation. RNET is calculated in cal/cm^2 per six-hours, as will be described, and is changed into mm of evaporation using the conversion factor of 58.6 cal/cm^2 to evaporate one mm of water.

The net radiation at the surface, RNET (cal/cm^2), is the difference between the net solar radiation, R_{SN}, and the net long wave or terrestrial radiation, R_{LN}:

$$R_{NET} = R_{SN} - R_{LN} \qquad (5)$$

Net solar radiation, R_{SN}, is that portion of the total incoming clear-sky solar radiation, $R_{SC}^{\downarrow}$, not attenuated by clouds and not reflected by the earth's surface:

$$R_{SN} = (1 - A)\, F_S R_{SC}^{\downarrow} \qquad (6)$$

where A is surface albedo expressed as a decimal from 0 to 1.

F_S is a solar radiation cloud factor which is a function of cloud type and amount

$R_{sc}\downarrow$ is the total incoming clear-sky solar radiation which is the sum of direct clear-sky solar radiation at the earth's surface, $R_s\downarrow$, and the diffuse solar radiation, R_d: $R_{sc}\downarrow = R_s\downarrow + R_d\downarrow$

Following is a presentation of the equations used in calculating the various components of the net solar radiation.

Surface albedo is calculated as a function of the stage of growth of the wheat crop expressed in terms of Biometeorological Time, BMT. The equations used are

$A = 0.10$ for bare ground ($BMT \leq 0$)

$A = 0.10 + 0.47BMT$ for the period between emergence and heading ($0 < BMT \leq 3.0$)

$A = 0.24$ for the period between heading and soft dough ($3 < BMT \leq 4$)

$A = 0.24 - 0.14(BMT-1)$ for the period between soft dough and ripe ($< 4\ BMT \leq 5$)

The formula used to estimate cloud factor for any given cloud conditions is

$$F_s = \Sigma\, n_t \cdot F_t + 1.0 - \Sigma\, n_t$$

where n_t is fraction of given cloud types, and F_t is overcast cloud factor for given cloud types.

The direct clear-sky solar radiation at the earth's surface is

$$R_s\downarrow = \int J_o \cos z\, \tau^{\sec z}\, dt \qquad (8)$$

where J_0 = solar constant (2 cal/cm^2/min). z = solar zenith angle, τ = atmospheric transmission coefficient and t = time.

The solar zenith angle is calculated by the following expression (SMT, p. 417):

$$\cos Z = \sin \Phi \sin \delta + \cos \Phi \cos \delta \cos h \qquad (9)$$

where Φ is latitude, δ is the sun's declination, h is the hour angle of the sun (angular distance of the sun from the meridian of the observer) and is expressed in degrees by

$$h = 15t + \theta - 180 \qquad (10)$$

where t is Greenwhich Mean Time and θ is longitude

The sun's declination is well approximated by

$$\delta = 23.5 \sin (2\pi (D - 80)/365) \qquad (11)$$

where D is day of year

The atmospheric transmission coefficient, τ, is calculated using the relationship developed by McDonald (1960) and corrected for depletion due to dust:

$$\tau = 0.95 - 0.077 u^{0.3} \qquad (12)$$

where the atmospheric water vapor, u (cm. of precipitable water), is estimated from the surface vapor pressure, e_a, by (McDonald, 1960):

$$\log_{10} u = -0.579 + 0.247\sqrt{e_a} \qquad (13)$$

The direct solar radiation for six hours is obtained by substituting h in terms of t in equation (9) and integrating equation (8) in steps of half hour intervals for the six-hour period.

The diffuse solar radiation at the earth's surface, R_d, is estimated by (SMI, p. 240):

$$R_d^{\downarrow} = \frac{0.91\ R_o + R_s^{\downarrow}}{2} \tag{14}$$

where R_o is the incoming solar radiation at the top of the atmosphere and is calculated by

$$R_o = \int J_o \cos z \, dt \tag{15}$$

where all the symbols are as previously defined, and the integration is done for a six-hour period.

The net long wave radiation, R_{LN} (cal/cm^2), is that portion of the long wave radiation that is lost to space:

$$R_{LN} = R_{LC}^{\uparrow} - F_L\ (\sigma\ T_a^4 - R_{LC}^{\uparrow}) \tag{16}$$

where $R_{LC}^{\uparrow}$ is the clear sky long wave radiation and is calculated by Geiger's method (1972):

$$R_{LC}^{\uparrow} = [\sigma\ T_a^4\ (.18 + .25 \times 10^{-065e}) - 0.007\ (T_a - T_g)] \tag{17}$$

where T_a is air temperature

T_g is ground temperature ($T_g = T_a$ in our calculations)

$\sigma = 8.132 \times 10^{-11}$ cal/cm^2/min/deg^4

e is vapor pressure at air temperature

F_L is the long wave radiation cloud factor calculated for a combination of cloud cover and type by

$$F_L = (\Sigma \sqrt{k_t}\, W_t)^2$$

W_t is fraction of given cloud type, and k_t is a constant which depends on the cloud type. Values of k_t are as follows (Geiger, 1972): Ci, 0.04; Cs, 0.08; Ac, 0.17; As, 0.20; Cu, 0.20; St, 0.24.

Precipitation

Precipitation reports are available every six hours from about two dozen stations in the area of interest. These are used in conjunction with cloud cover determined from SMS imagery to derive precipitation estimates in those I, J cells which do not have precipitation reports. The technique employed in estimating precipitation from cloud cover is based upon "calibration" of cloud type as to their rain potential, and is a refinement, of a technique used by Follansbee (1973). Follanbee's equation for estimating 24 hour average areal precipitation from cloud cover is

$$P \text{ (24 hour)} = k_1 \, Cb + k_2 N_s + k_3 Cc$$

where Cb, Ns, and Cc represent percentage of cumulonimbus, nimbostratus, and cumulus congestus clouds and k_1, k_2, k_3 are coefficients of 24 hour rainfall potential for each of the three rainproducing cloud types.

Our modified Follansbee equation for six-hour precipitation amount for an i,j cell is:

$$P\ (6\text{-hour}) = [k_1Cb + k_2Ns + k_3Cc]F \tag{18}$$

where k_1, k_2, k_3 are coefficients for 6-hour rainfall potential.

F is an adjustment factor calculated from precipitation ground reports and satellite cloud cover at the location of the ground reports as follows:

$$F = \sum_{1}^{n} P_R / \sum_{1}^{n} P_E \tag{19}$$

The numerator is simply the summation of the reported 6-hour precipitation, P_R, at stations 1 to n. The denominator is the summation of the estimated 6-hour precipitation, P_E, for the i,j cells of the stations 1 to n, and is calculated by

$$P_E = k_1Cb + k_2Ns + k_3Cb$$

F is not allowed to exceed 3 or to be below 1/3. In these cases F is set equal to 1. These are arbitrary limits meant to exclude conditions of insufficient cloud cover information or insufficient rainfall reports over the ground stations, which would make the calculation of the factor F unreliable.

When only infrared images are available (00-06 GMT and 06-12 GMT intervals) then the equation used is simply

$$P_E = [k_4 B]F \tag{20}$$

where B is fraction (0 to 1) of brightest (coldest) area, k_4 is an empirically determined constant, and F is an adjustment factor caluclated by:

$$F = \sum_{1}^{n} P_R / \sum_{1}^{n} k_4 B_n \tag{21}$$

F is calculated from the available stations rainfall reports and the observed infrared brightnesses above these stations. Again, F is not allowed to exceed 3 or to be below 1/3. In these cases F is set equal to 1.

An initial value of $k_4 = 1/3(k_1 + k_2 + k_3) = 0.890$ was chosen for the first week (1-6 June 1975 calculations). Each following week the value of k_4 was scaled up or down by the ratio of precipitation estimated to precipitation observed at the 24 stations in the area during the 12 hour period (00-12 GMT) in which infrared images are used for the precipitation estimates.

5.1.1.3 METRUN EXECUTION

Job Control Language

```
//METRUN  JOB  (BR9001,746),ANDERSON,CLASS=F
//METSTEP EXEC FORTGCLG,PARM.FORT='MAP,ID',REGION.GO=140K
//*
//*          MODULE METRUN
//*
//FORT.SYSIN DD

                    -  Source Deck  -

//LKED.SYSLIB     DD
//                DD DSN=EARTHSAT,LOADLIB.DISP=SHR
//GO.SYSIN        DD *
                     *

              -  input data cards for FT05F001  -

//FT29F001 DD DUMMY,DCB=BLKSIZE=20
//FT30F001 DD DSN=RWA.STAIJ,UNIT=2400
// DISP=(OLD,KEEP,KEEP),DCB=(RECFM=FB,LRECL=76,BLKSIZE=760)
//FT31F001 DD DUMMY,DCB=BLKSIZE=20
//FT32F001 DD DSN=MET,UNIT=SYSDA,DISP=(NEW,CATLG),
// SPACE=(CYL,(10,4),RLSE),
//  DCB=(RECFM=F,BLKSIZE=20)
//SYSUDUMP DD SYSOUT=A
//FT09F001 DD *

              -  update data cards for FT09F001

               -  FT09F001 input data cards  -
```

Data Definition Description

1) FT05F001: Station & Satellite data.

2) FT06F001: Printer display file.

3) FT09F001: Map overlay data for output display.

4) FT29F001: Data for days processed in previous cycle; last day initializes model for first day in this cycle.

5) FT30F001: Initialization file for region specific constants.

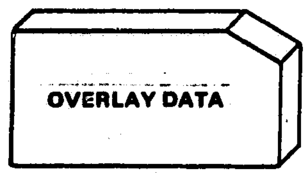
6) FT31FØØ1: 6 hr data with daily summation, used for error analysis of MET model.

7) FT32FØØ1: Data for days processed in present cycle becomes input in the following cycle.

5.1.1.4 DATA DESCRIPTION

FT09F001 INPUT DATA

1. SEQUENCE



29 CARDS

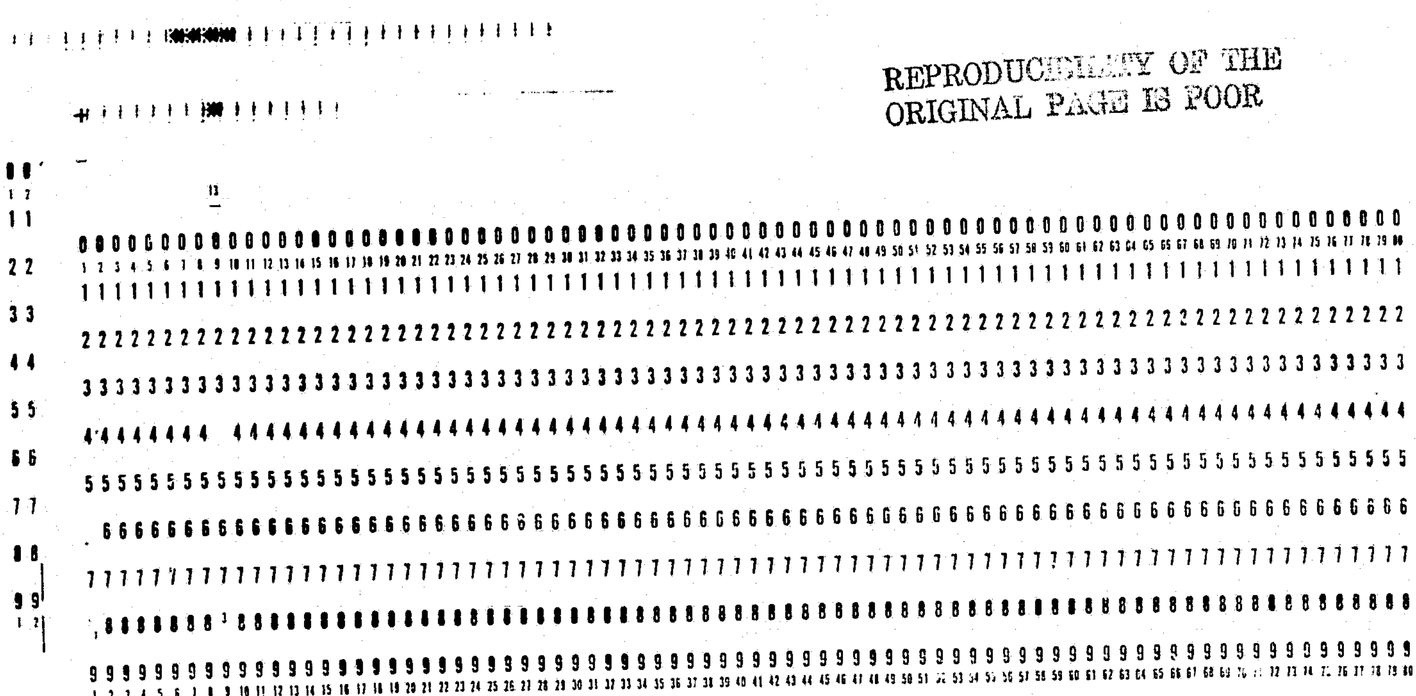
MAP OVERLAY DATA CARD

METRUN MAP OVERLAY DATA CARD

FORMAT: (7A8)

Variable	Format	Cols	Description
AMAPIJ(1,1,1,1)	A8	Card 1 1-8	1st 8 cols of map overlay line 1 1st half
. . .			
	A8	72-80	
AMAPJJ(1,2,28,1)	A8	Card 2 72-80	Line one last 8 cols 1st half of overlay
. . .			
AMAPIJ(1,1,1,2)	A8	Card 29 1-8	1st 8 cols of map overlay line 1 last half
. . .			
AMAP(7,2,28,2)	A8	72-80	Last 8 cols of map overlay last line

SAMPLE DATA CARDS (2 cards):



INPUT DATA ON FT05F001

1. SEQUENCE

Card	Number	Name
READ C1...C10 COEFF. FOR RAINFALL EQUATION	1 CARD	RAIN COEFFICIENT CARD
BOUNDARIES OF ANALYSIS AREA ETC.	1 CARD	AREA BOUNDARY CARD
6 HR INTERVAL DAY, TIME,...ETC. 06 GMT	1 CARD	TIME INTERVAL CONTROL CARD
SAT CLOUD COVER FOR 6HR INTERVAL 0-06 GMT	1 CARD PER POLYGON	CLOUD POLYGON CARD
K=0 in column 17	1 CARD ENDS 6HR INTERVAL	END CLOUD POLYGON CARD
STATION DATA FOR 06 GMT	1 CARD PER STATION 34 CARDS	STATION DATA CARD

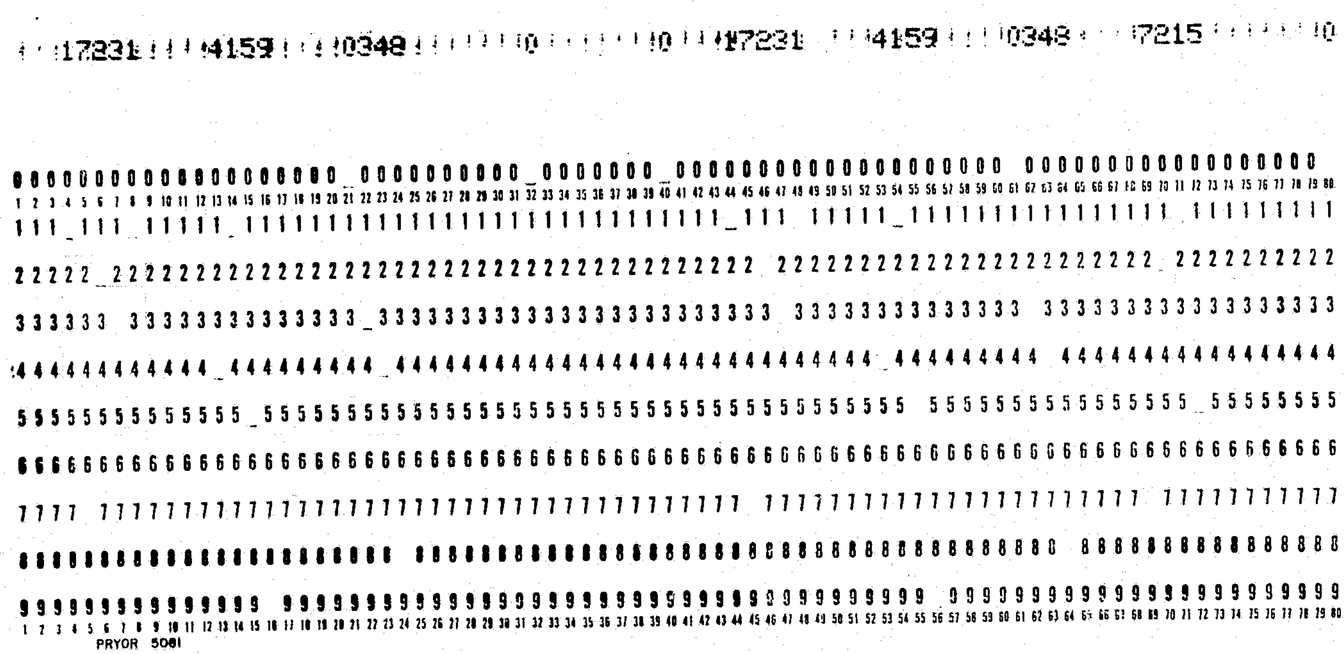
FOR 06-12-18-24 GMT PER EACH DAY

RAIN COEFFICIENTS CARD

Format: (10F8.4)

Variable	Format	Cols	Description
C1	F8.4	1-8	
C2	F8.4	9-16	
C3	F8.4	17-24	
C4	F8.4	25-32	Rain coefficients for satellite
C5	F8.4	33-40	rain equation
C6	F8.4	41-48	
C7	F8.4	49-56	
C8	F8.4	57-64	
C9	F8.4	65-72	
C10	F8.4	73-80	

Sample Card

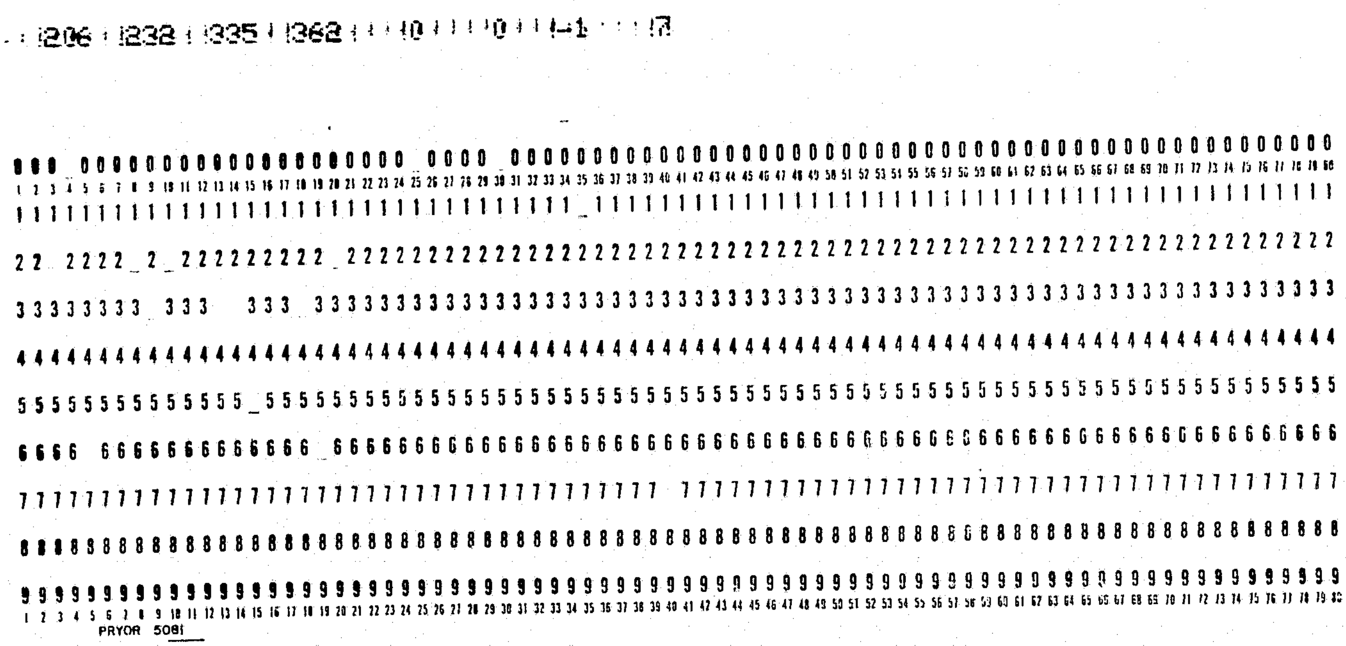


AREA BOUNDARY CARD - PROCESSING PERIOD

Format: (8I5,2F10.3)

Variable	Format	Cols	Description
IFIRST	I5	1-5	
ILAST	I5	6-10	Limits of I, J Area
JFIRST	I5	11-15	
JLAST	I5	16-20	
IDIS	I5	21-25	0
JDIS	I5	26-30	0
IEAST	I5	31-35	(-1) West, (+1) East Longitude
NDAYS	I5	36-40	Days to Process
FMAX	F10.3	41-50	Temperature Coefficients
FMIN	F10.3	51-60	

Sample Card:

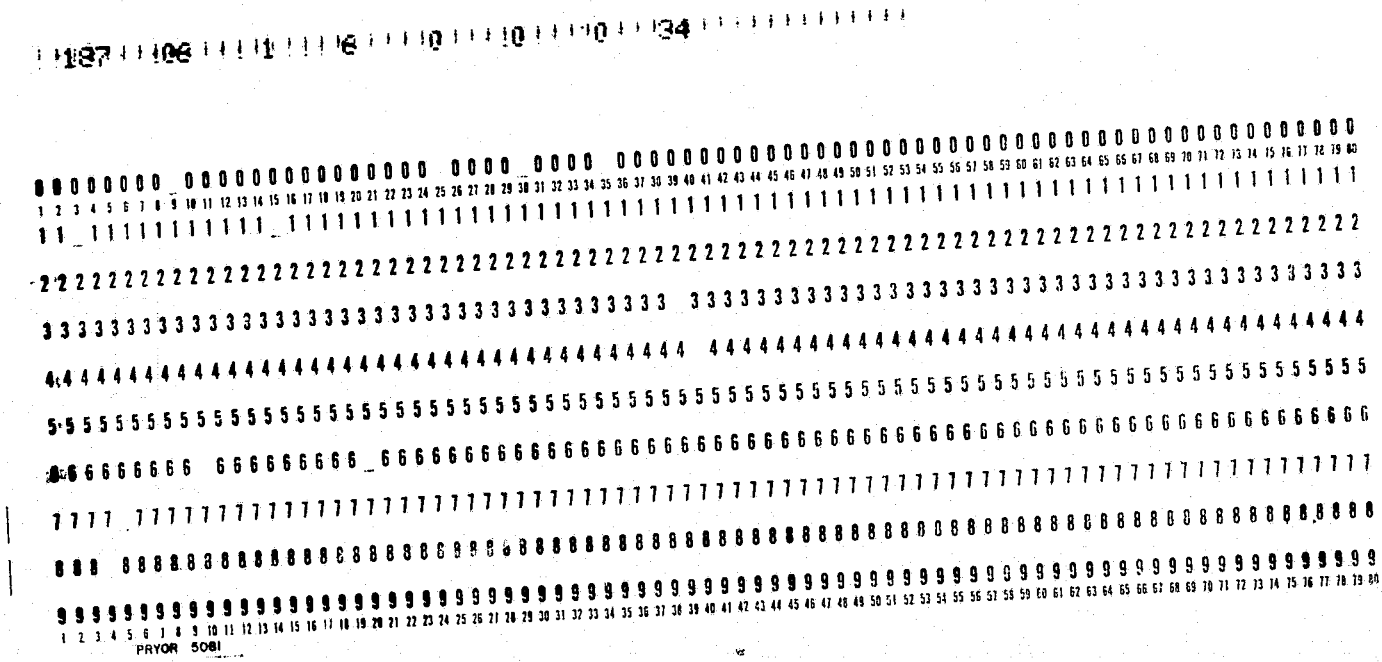


TIME INTERVAL CONTROL CARD

Format: (8I5,2F10.3)

Variable	Format	Cols	Description
IDAY	1-5	I5	Julian Day
ITIME	6-10	I5	GMT Time
KI	11-15	I5	(1) Freq of ground obs in 6Hr interval
IDEL2	16-20	I5	Verification Variable
IRNO	21-25	I5	Switch for IR SAT Images 1=yes 0=no
IVNO	26-30	I5	Switch for Vis Sat Images 1=yes 0=no
ITEST	31-35	I5	Satellite Image Indicator
NSTA	36-40	I5	Number of Stations

Sample Card



CLOUD POLYGON CARD

Format: (I3, I4, 10I1 (9F3.1, F4.1))

Variable	Format	Cols	Description
ID	I3	1-3	Day
IT	I4	4-7	GMT Time of Satellite Image
ICC(1)	I1	8	8th of Cumulonimbus clouds in polygon - Visible images
ICC(2)	I1	9	8th of Nimbostratus clouds in polygon - Visible images
ICC(30)	I1	10	8th of Cumulus Congestus clouds in polygon - Visible images
ICC(4)	I1	11	8th of Stratus clouds in polygon - Visible images
ICC(5)	I1	12	8th of Stratocumulus clouds in polygon - Visible images
ICC(6)	I1	13	8th of Cumulus clouds in polygon - Visible images
ICC(7)	I1	14	8th of Cirus clouds in polygon - Visible images
ICC(8)	I1	15	8th of Brightest area in IR Image
ICC(9)	I1	16	8th of Bright area in IR Image
K	I1	17	Number of Polygon Vertices
XLA(1)	F3.1	18-20	Latitude of First Polygon Corner
XLO(1)	F4.1	21-24	Longitude of First Polygon Corner
to XLA(K) XLO(K)	F3.1 F4.1	25-80	Latitude and Longitude of Nth Polygon Corner

Sample Card

1870715 128488 9654881000483104049210424901080500109552010805401015

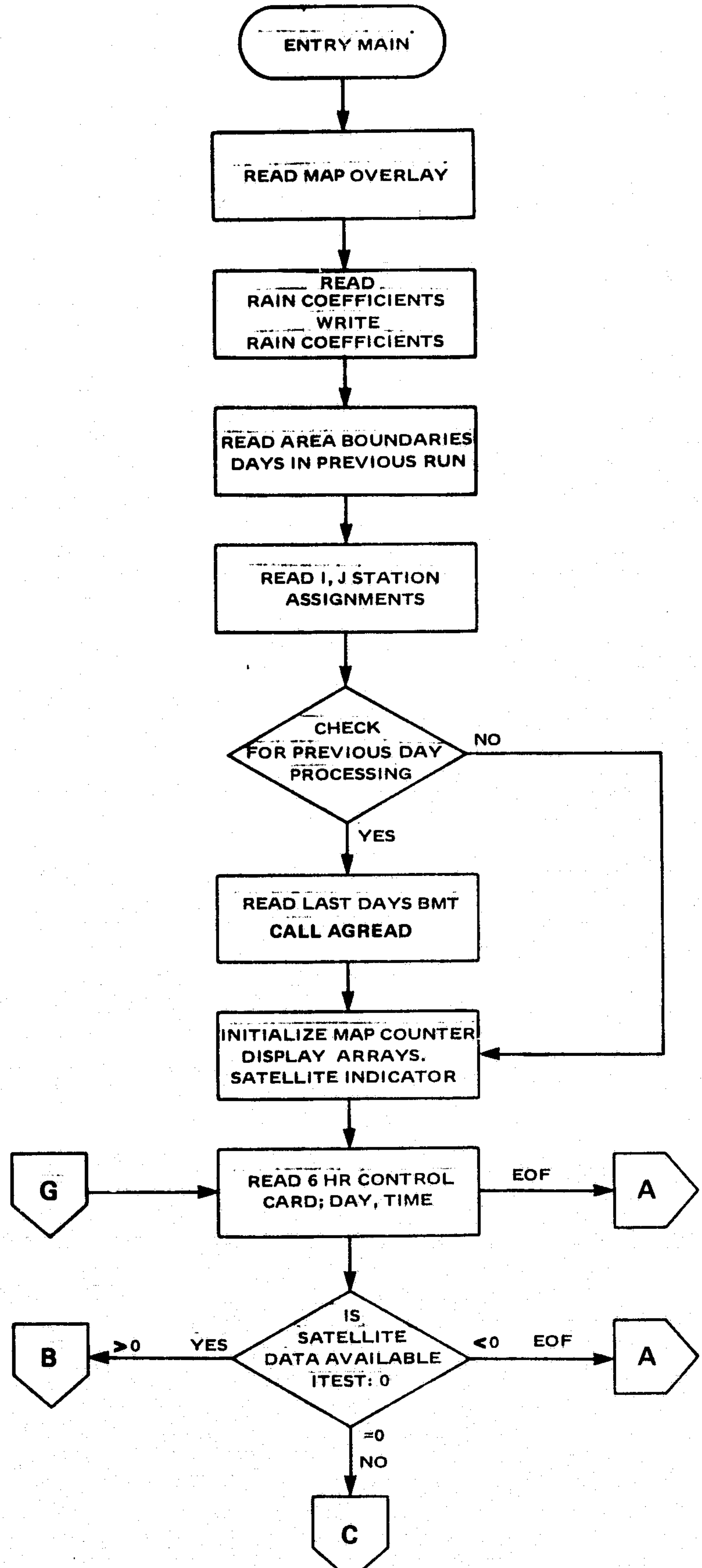
STATION - DATA CARD

Format: (I3, 3I2, 2I3, 2X, I2, I3, 3I2, 2X, I2, 3X, I1, I2, I1, 2X, I1, I4, 2X, I1, I4, 2X, I1, 2I2)

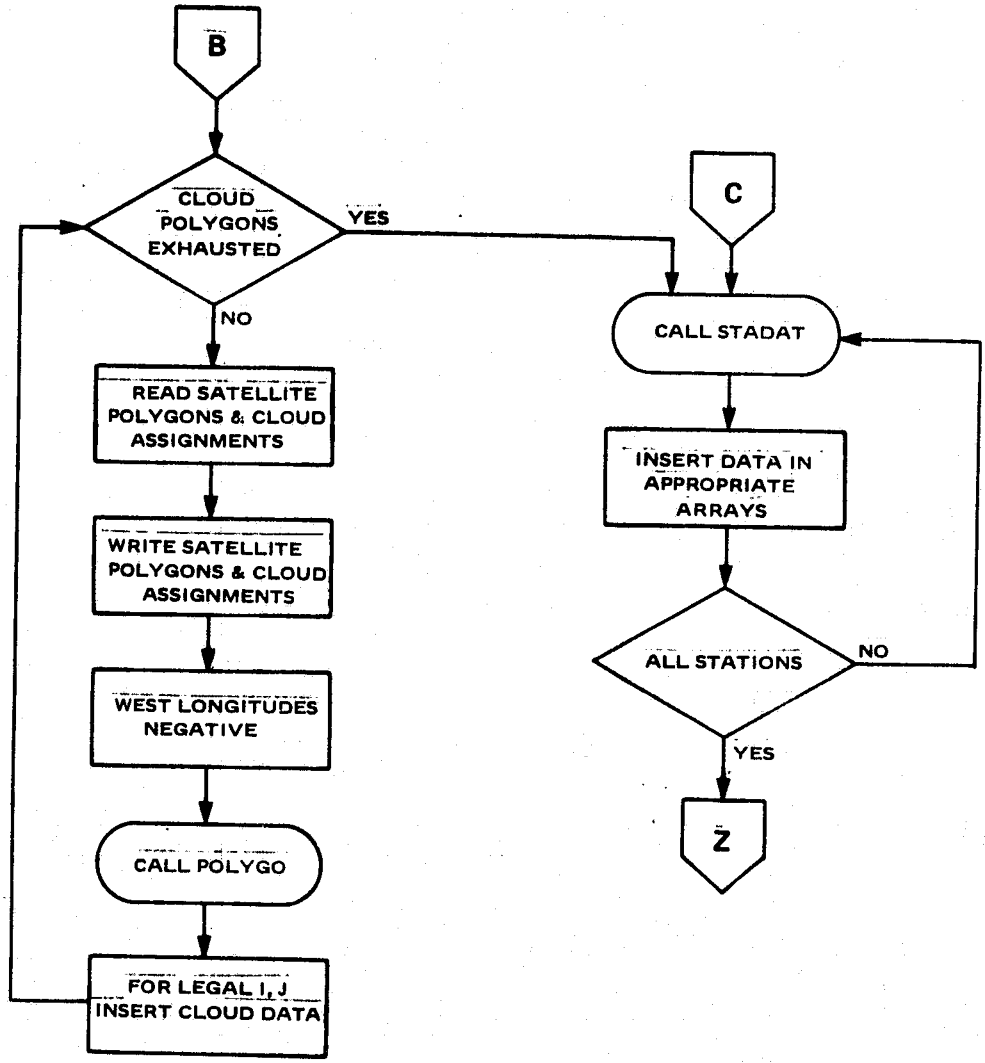
Variable	Format	Cols	Description
NST	I3	1-3	Station Number
M	I2	4-5	Month
IDY	I2	6-7	Day
IHR	I2	8-9	Hour
N	I3	10-12	Total Cloud
IW	I3	13-15	Wind Speed Knots
IT	I2	18-19	Temperature
NH	I3	20-22	Amount of Low or Middle Cloud
ITY(1)	I2	23-24	Amount Low Cloud
ITY(2)	I2	25-26	Amount Middle Cloud
ITY(3)	I2	27-28	Amount High Cloud
ID	I2	31-32	Dew Point
K7	I1	36	Previous 6HR Rainfall Switch
JPR	I2	37-38	Previous 6HR Rainfall in Hundreths
IPR	I1	39	Inches Rainfall in Previous 6HR
K9	I1	42	Special Phenomena Switch
ISG	I4	43-46	Special Phenomena Identification
K2	I1	49	Previous 24 hr. Rainfall Switch
IP24	I4	50-53	24 Hour Rainfall Amount in Hundreths
K4	I1	56	Temperature Data Switch
IMX	I2	57-58	Maximum 6Hr Temperature
IMN	I2	59-60	Minimum 6Hr Temperature

787 70612 8 08 19 8 9 1 1 19 710 20010 49284

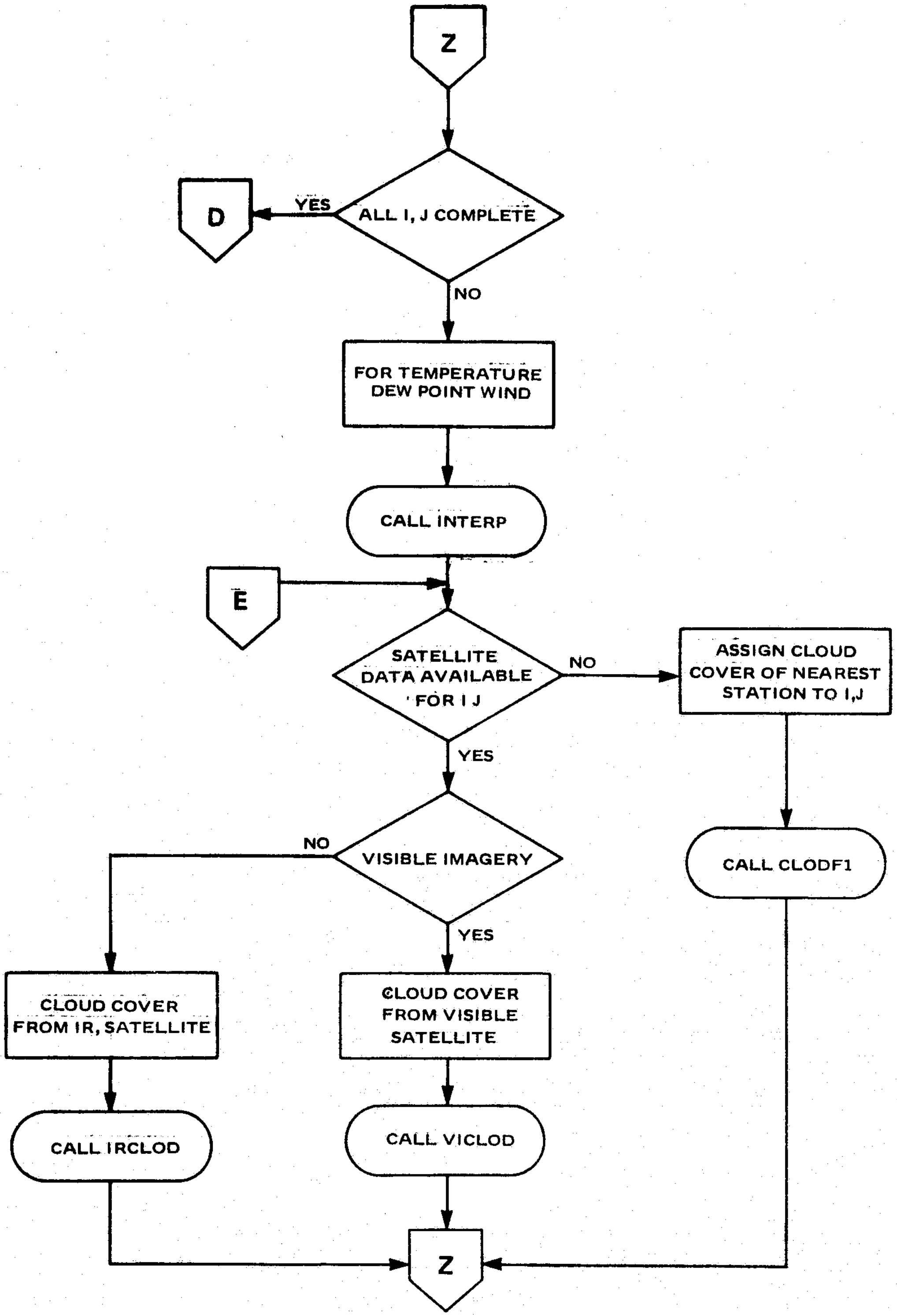
5.1.1.5 FLOWCHART



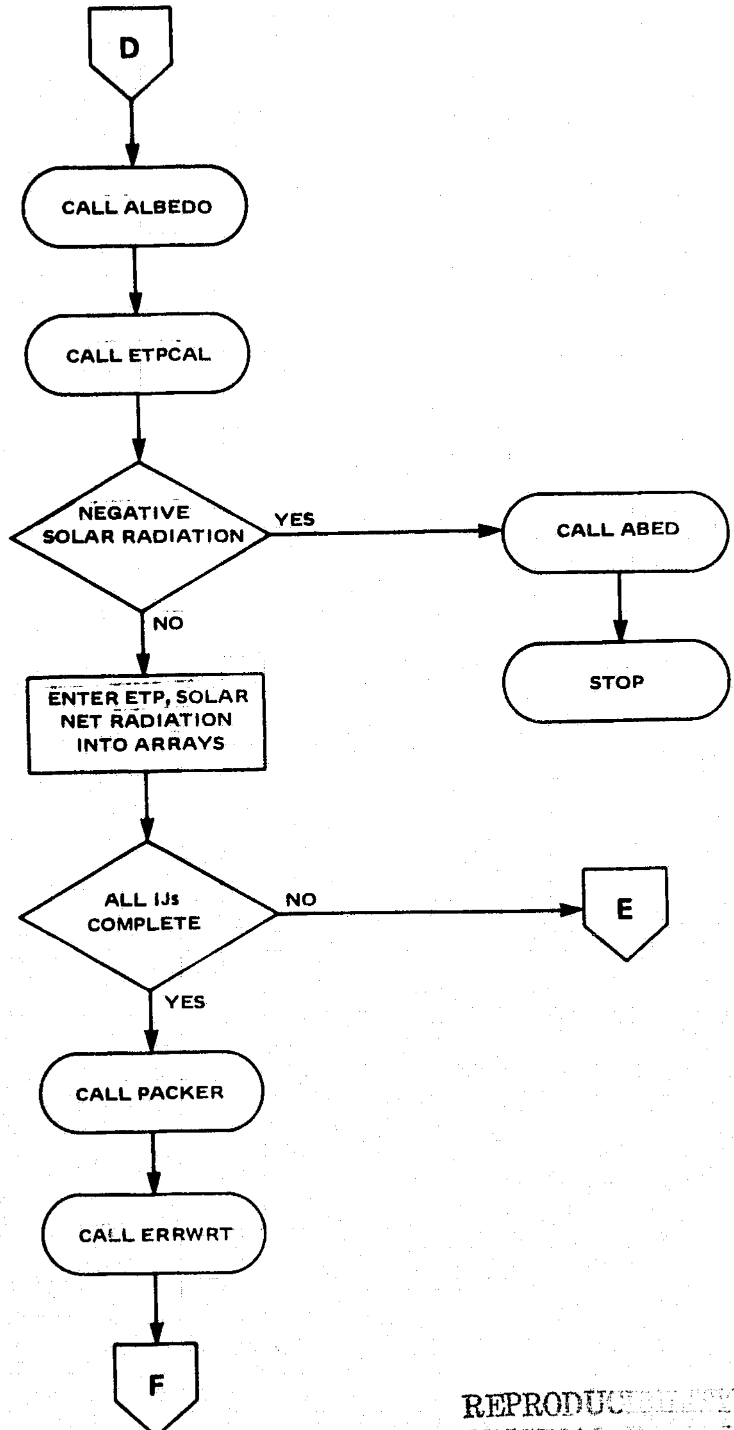
METRUN


B
CLOUD POLYGONS EXHAUSTED
YES
NO
READ SATELLITE POLYGONS & CLOUD ASSIGNMENTS
WRITE SATELLITE POLYGONS & CLOUD ASSIGNMENTS
WEST LONGITUDES NEGATIVE
CALL POLYGO
FOR LEGAL I, J INSERT CLOUD DATA
C
CALL STADAT
INSERT DATA IN APPROPRIATE ARRAYS
ALL STATIONS
NO
YES
Z

METRUN

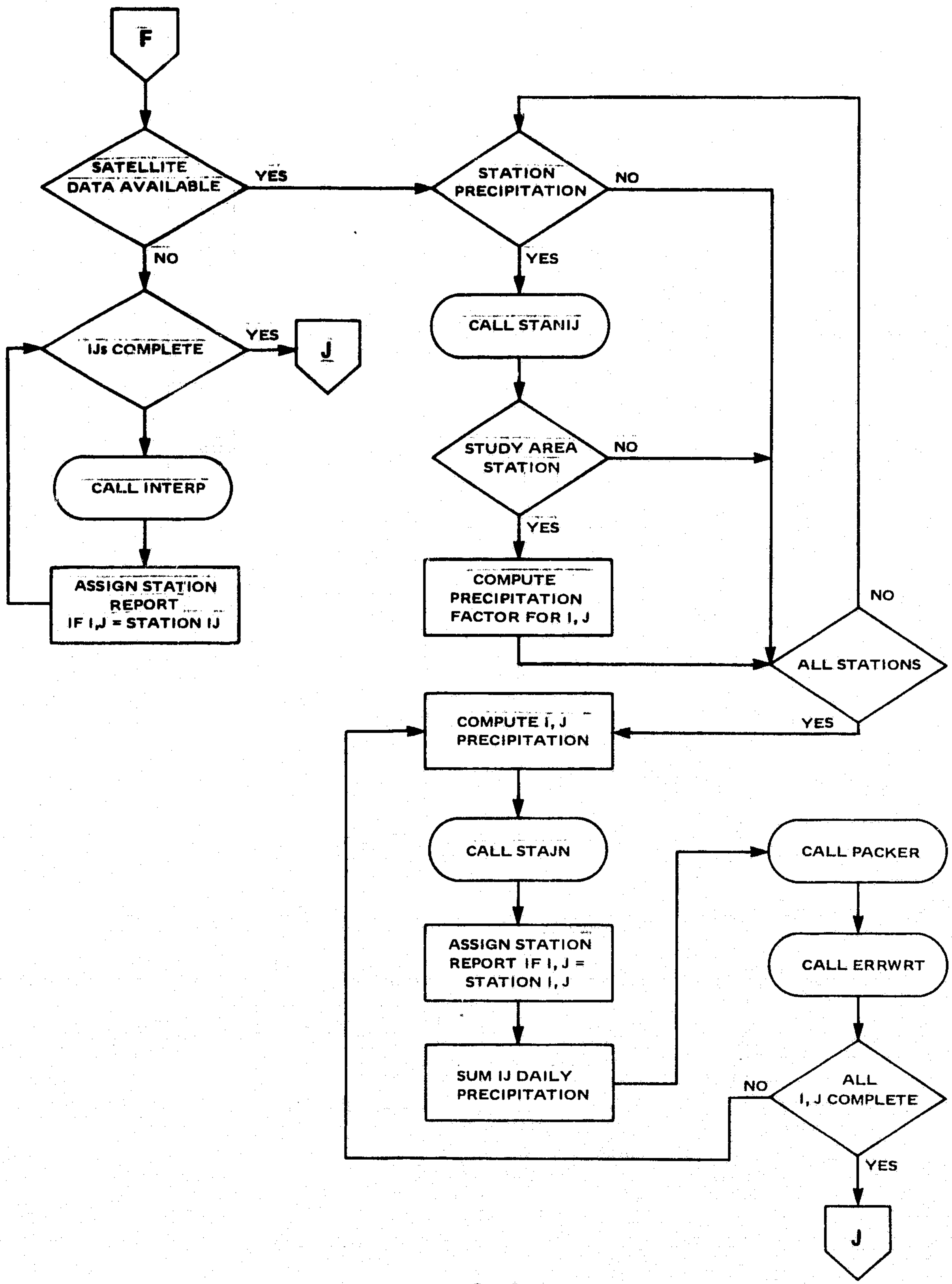

Z
ALL I, J COMPLETE
YES
D
NO
FOR TEMPERATURE
DEW POINT WIND
CALL INTERP
E
SATELLITE
DATA AVAILABLE
FOR I J
NO
ASSIGN CLOUD
COVER OF NEAREST
STATION TO I,J
YES
VISIBLE IMAGERY
NO
YES
CALL CLODF1
CLOUD COVER
FROM IR, SATELLITE
CLOUD COVER
FROM VISIBLE
SATELLITE
CALL IRCLOD
CALL VICLOD
Z

METRUN



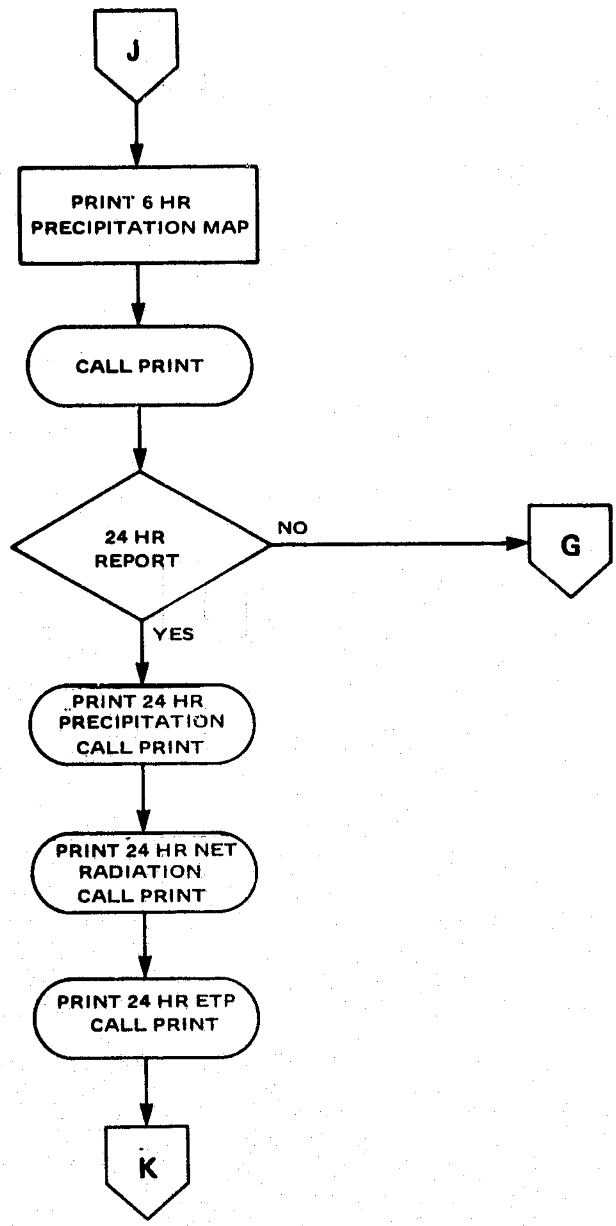
D
CALL ALBEDO
CALL ETPCAL
NEGATIVE SOLAR RADIATION
YES
CALL ABED
STOP
NO
ENTER ETP, SOLAR NET RADIATION INTO ARRAYS
ALL IJs COMPLETE
NO
E
YES
CALL PACKER
CALL ERRWRT
F

METRUN

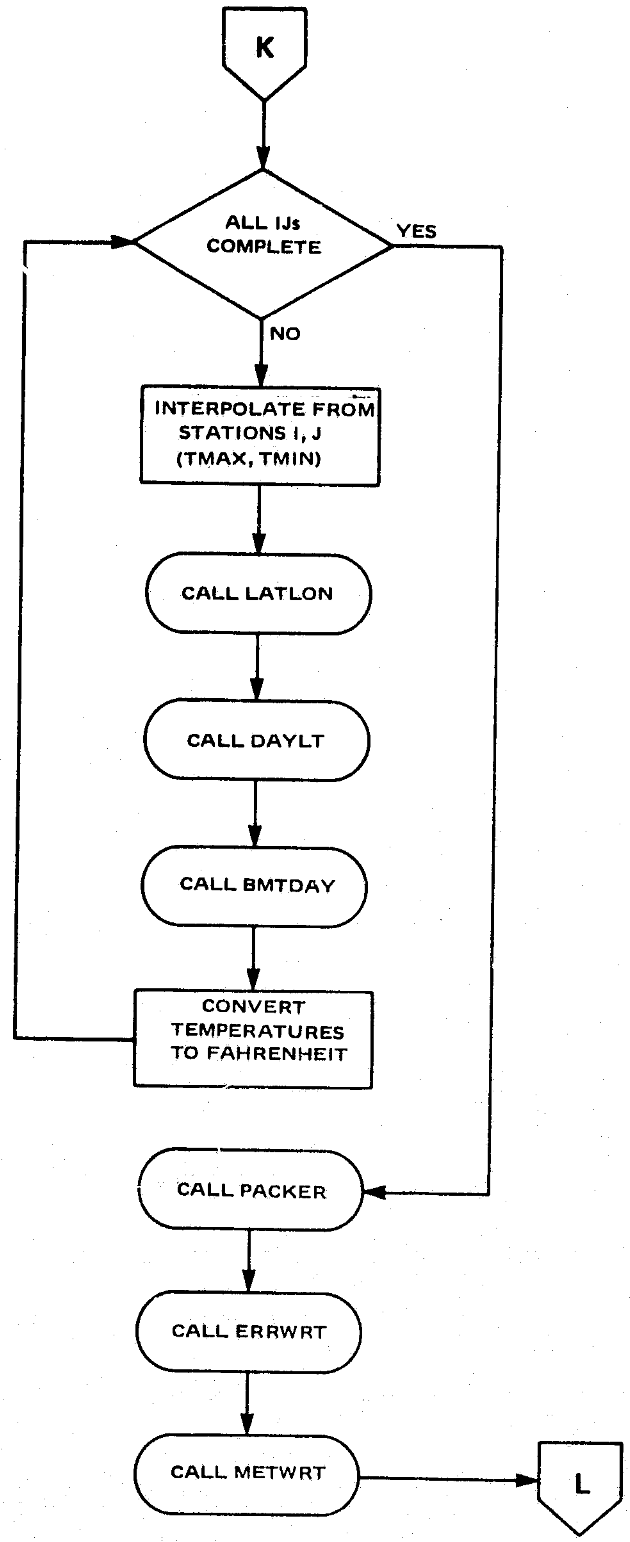


F
SATELLITE DATA AVAILABLE
YES
NO
IJs COMPLETE
YES
J
CALL INTERP
ASSIGN STATION REPORT IF I,J = STATION IJ
STATION PRECIPITATION
NO
YES
CALL STANIJ
STUDY AREA STATION
NO
YES
COMPUTE PRECIPITATION FACTOR FOR I, J
NO
ALL STATIONS
YES
COMPUTE I, J PRECIPITATION
CALL STAJN
ASSIGN STATION REPORT IF I, J = STATION I, J
SUM IJ DAILY PRECIPITATION
CALL PACKER
CALL ERRWRT
NO
ALL I, J COMPLETE
YES
J

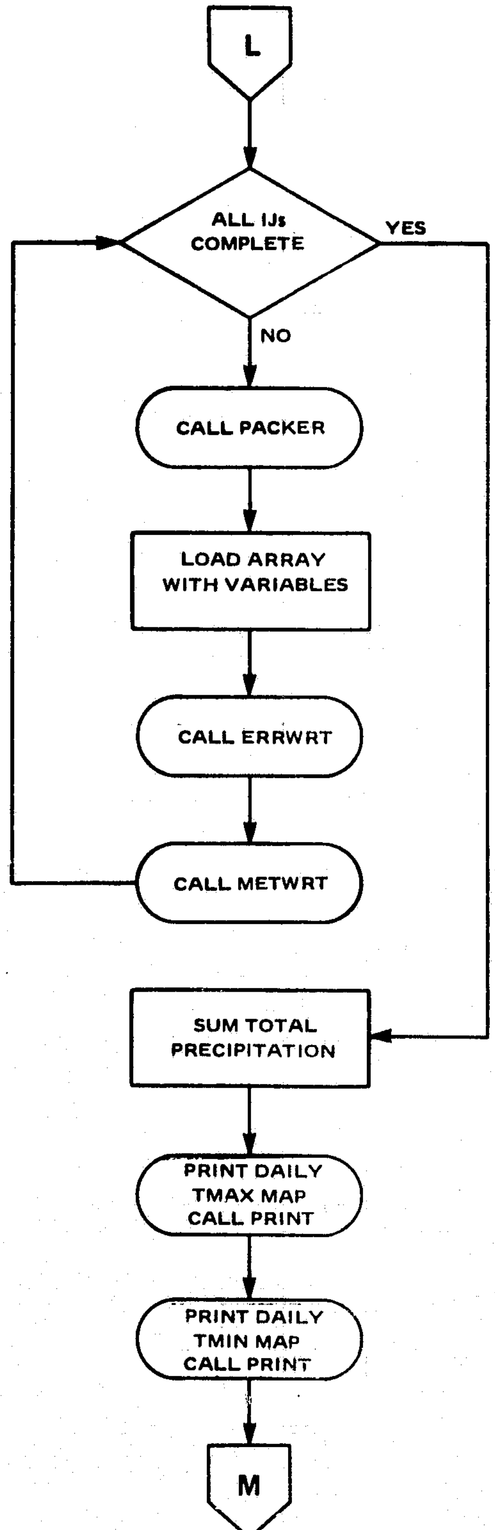
METRUN


J
PRINT 6 HR
PRECIPITATION MAP
CALL PRINT
24 HR
REPORT
NO
G
YES
PRINT 24 HR
PRECIPITATION
CALL PRINT
PRINT 24 HR NET
RADIATION
CALL PRINT
PRINT 24 HR ETP
CALL PRINT
K

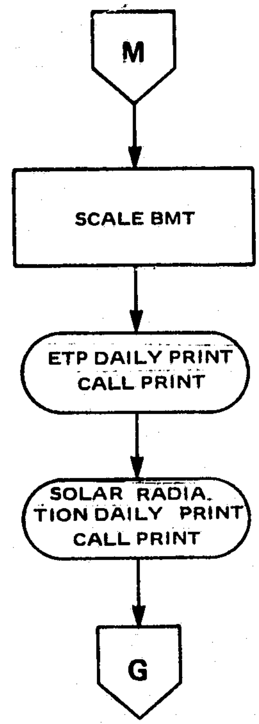
METRUN

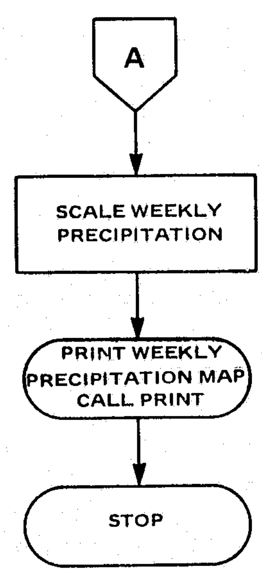

K
ALL IJs COMPLETE
YES
NO
INTERPOLATE FROM STATIONS I, J (TMAX, TMIN)
CALL LATLON
CALL DAYLT
CALL BMTDAY
CONVERT TEMPERATURES TO FAHRENHEIT
CALL PACKER
CALL ERRWRT
CALL METWRT
L

METRUN

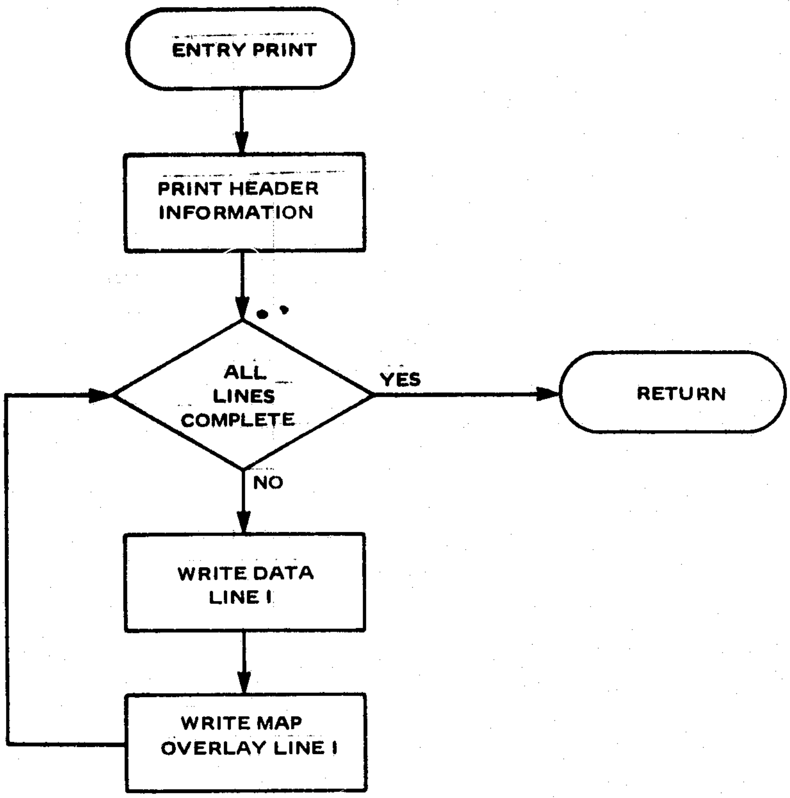

L
ALL IJs COMPLETE
YES
NO
CALL PACKER
LOAD ARRAY WITH VARIABLES
CALL ERRWRT
CALL METWRT
SUM TOTAL PRECIPITATION
PRINT DAILY TMAX MAP CALL PRINT
PRINT DAILY TMIN MAP CALL PRINT
M

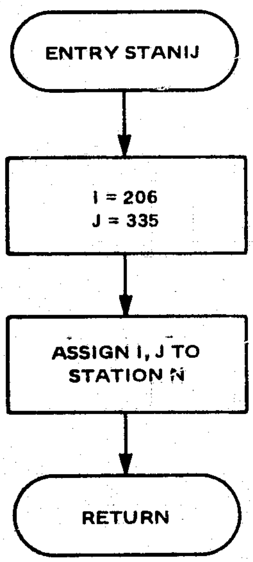
METRUN


M
SCALE BMT
ETP DAILY PRINT
CALL PRINT
SOLAR RADIA.
TION DAILY PRINT
CALL PRINT
G

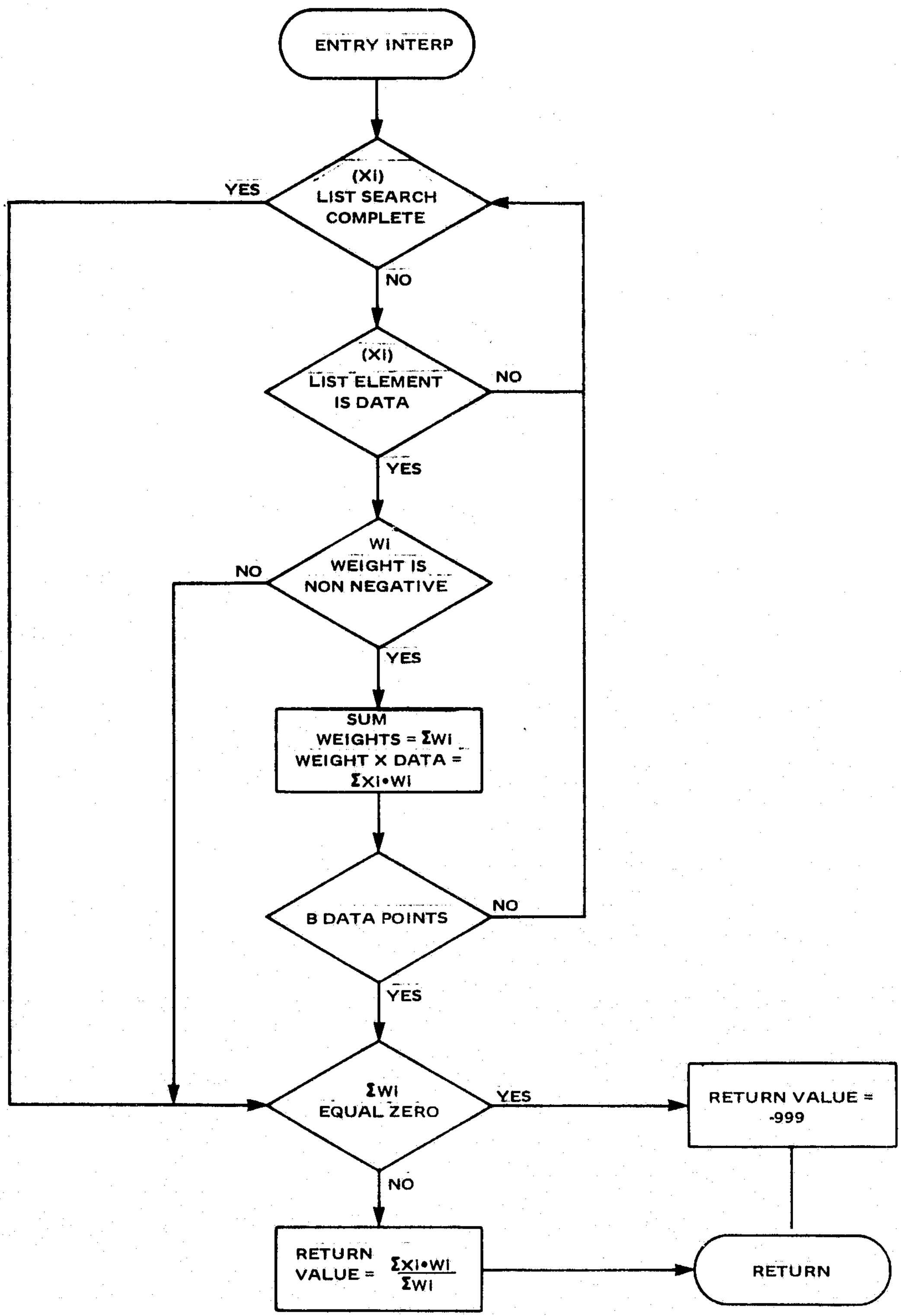

A
SCALE WEEKLY
PRECIPITATION
PRINT WEEKLY
PRECIPITATION MAP
CALL PRINT
STOP

SUBROUTINE PRINT

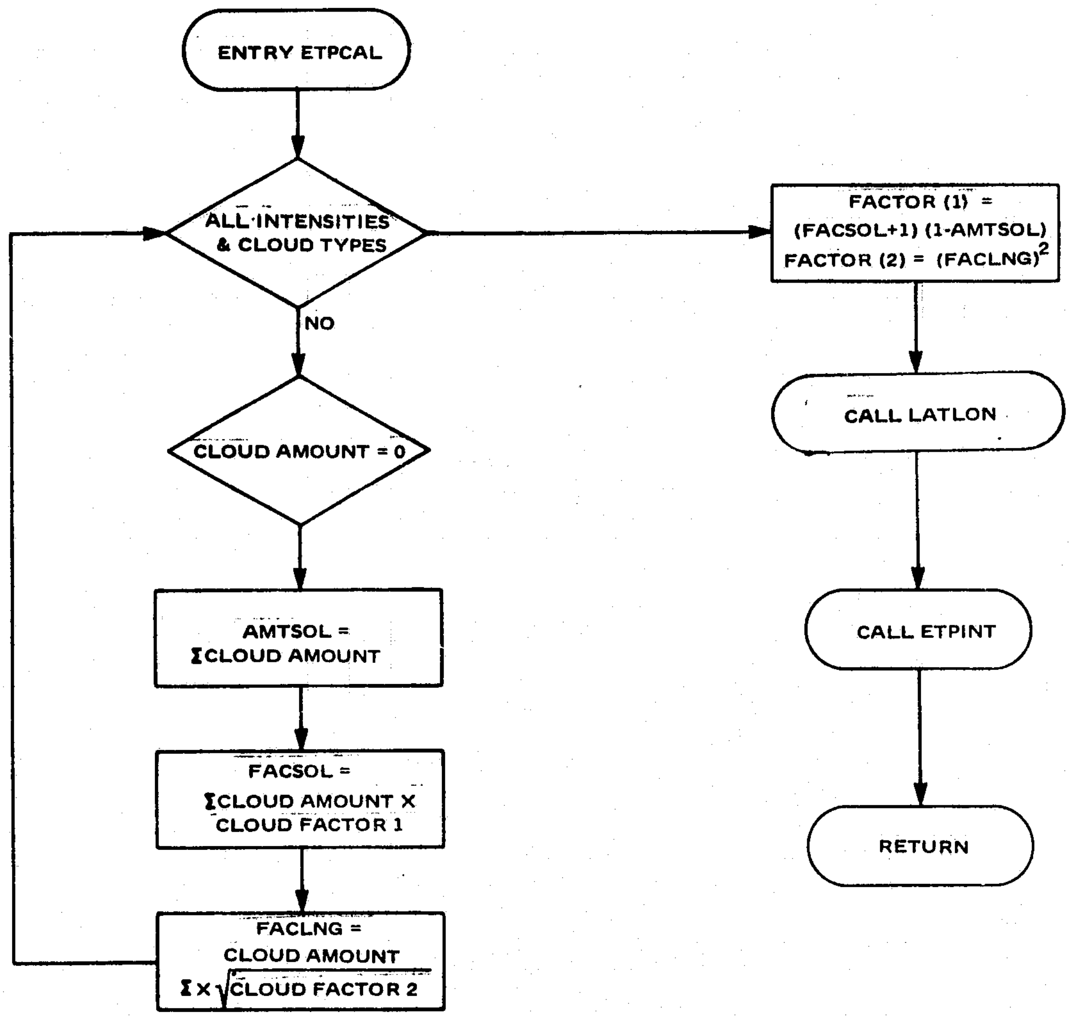




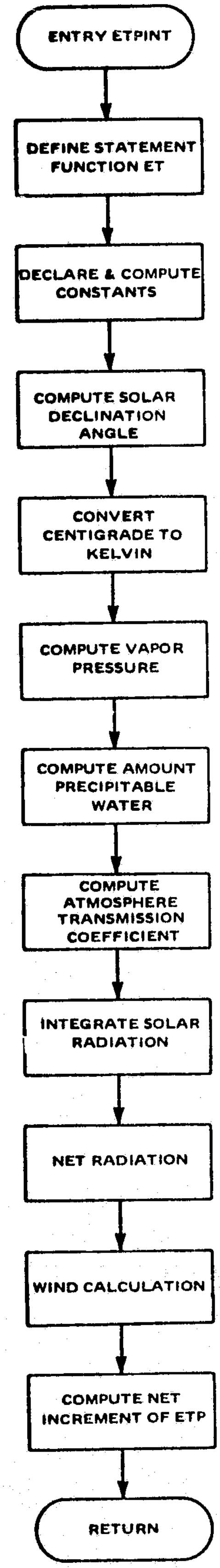
SUBROUTINE INTERP



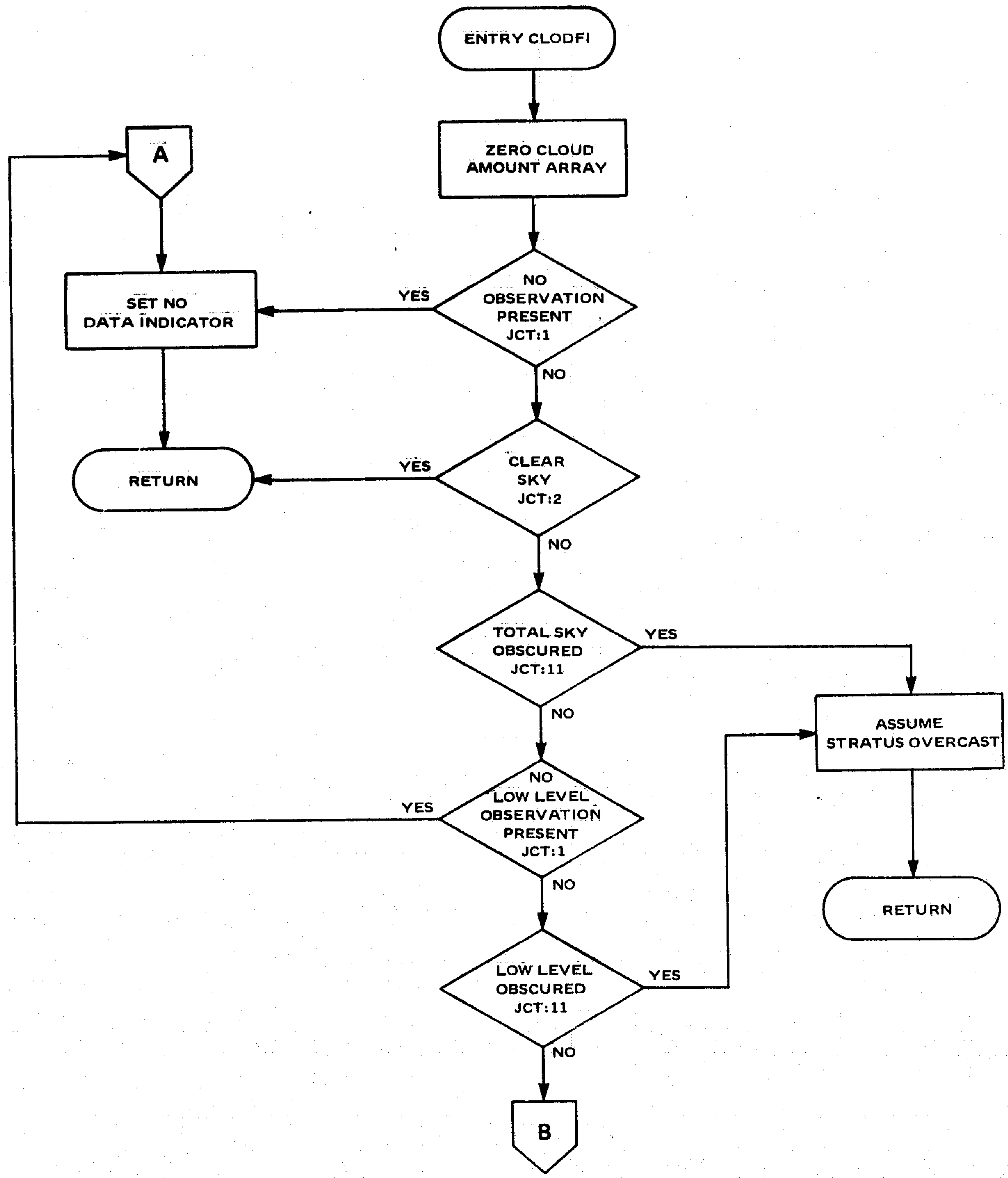
SUBROUTINE ETPCAL

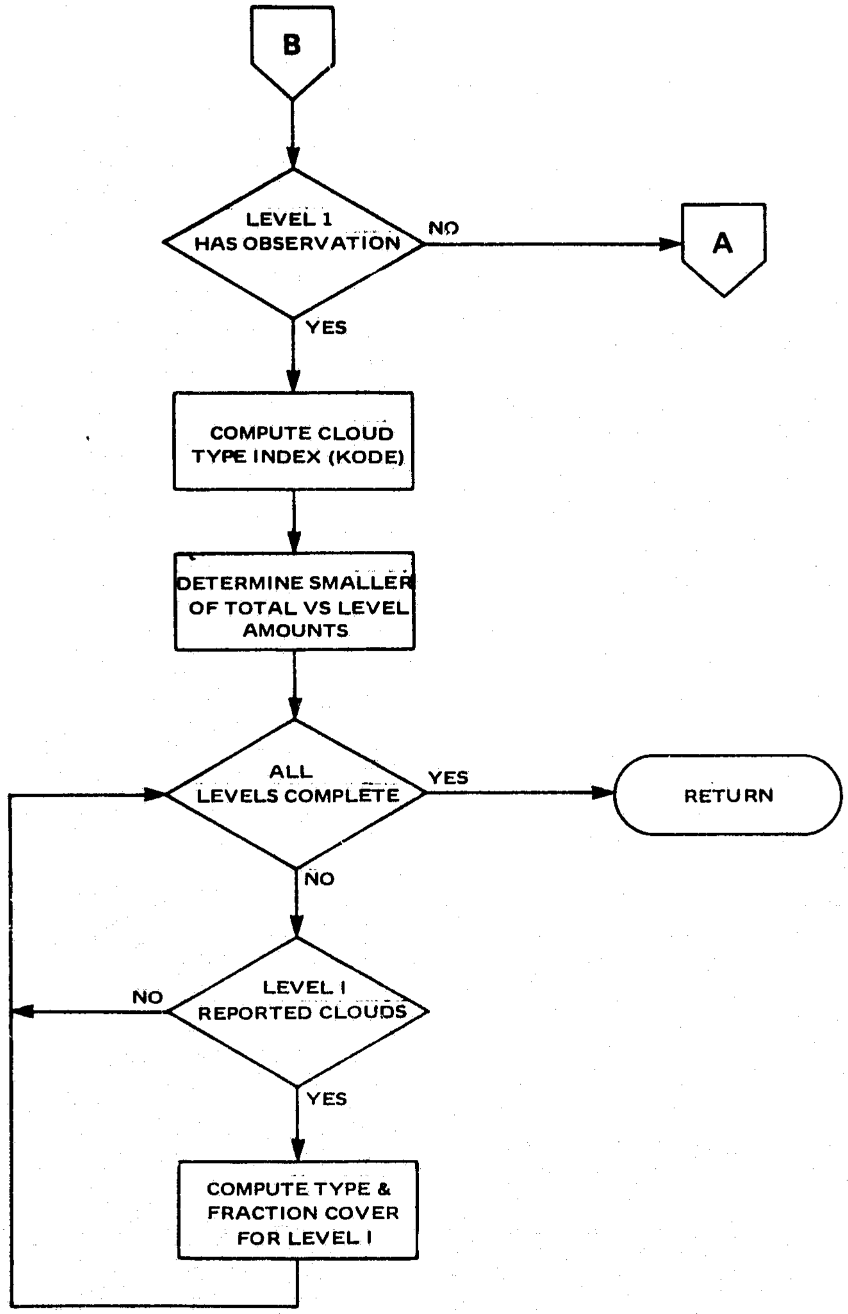


SUBROUTINE ETPINT

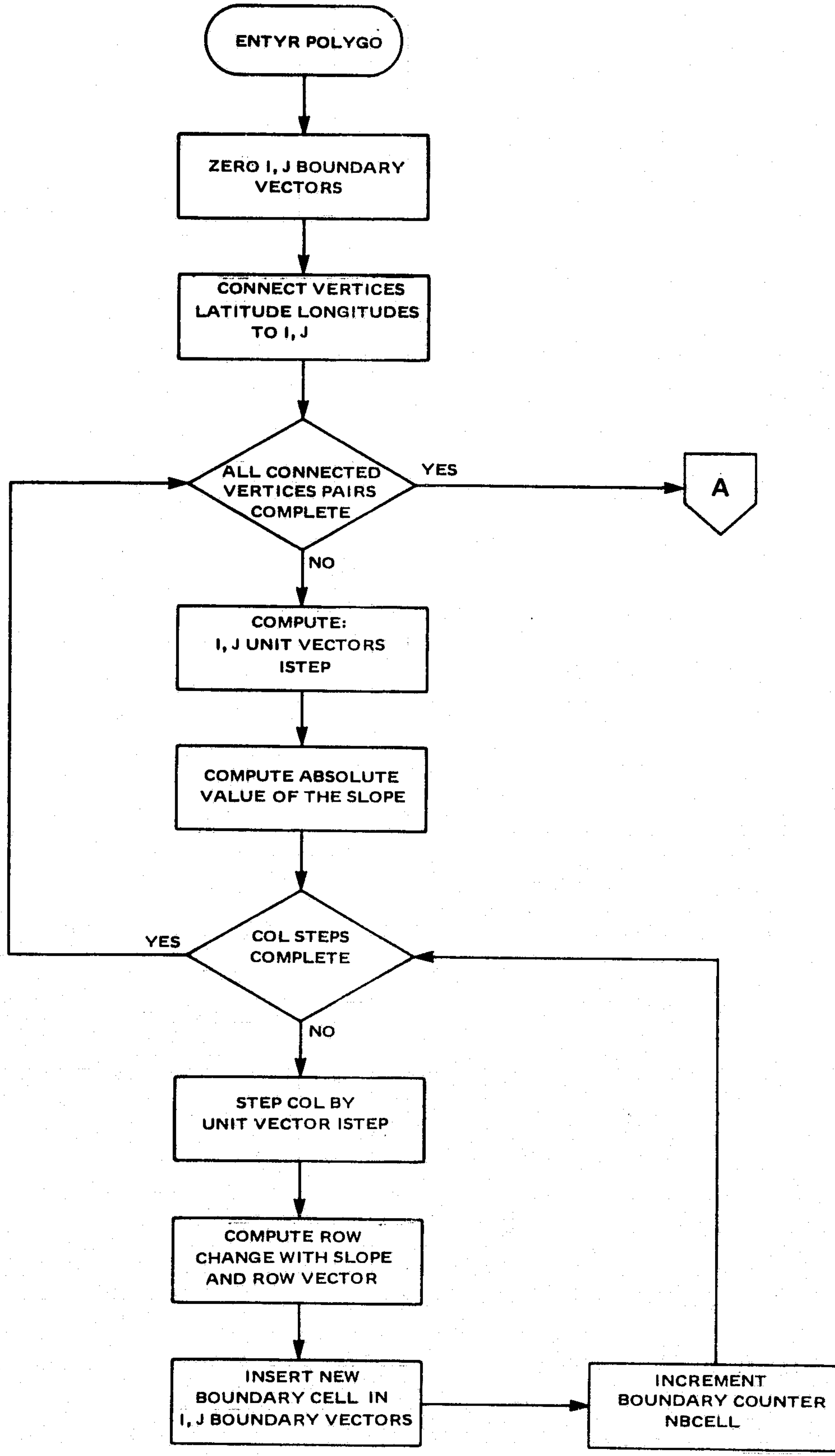


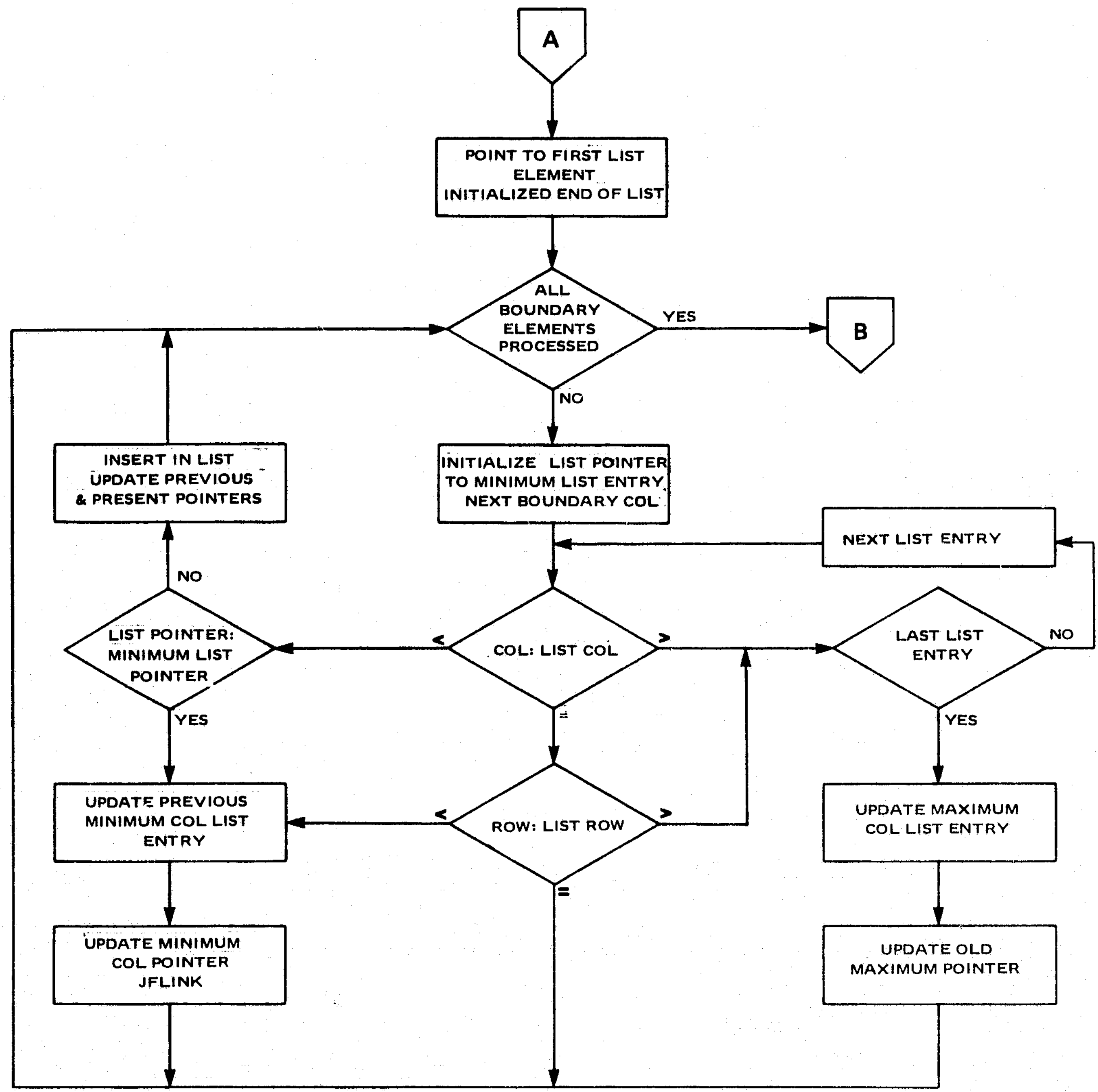
SUBROUTINE CLODFI

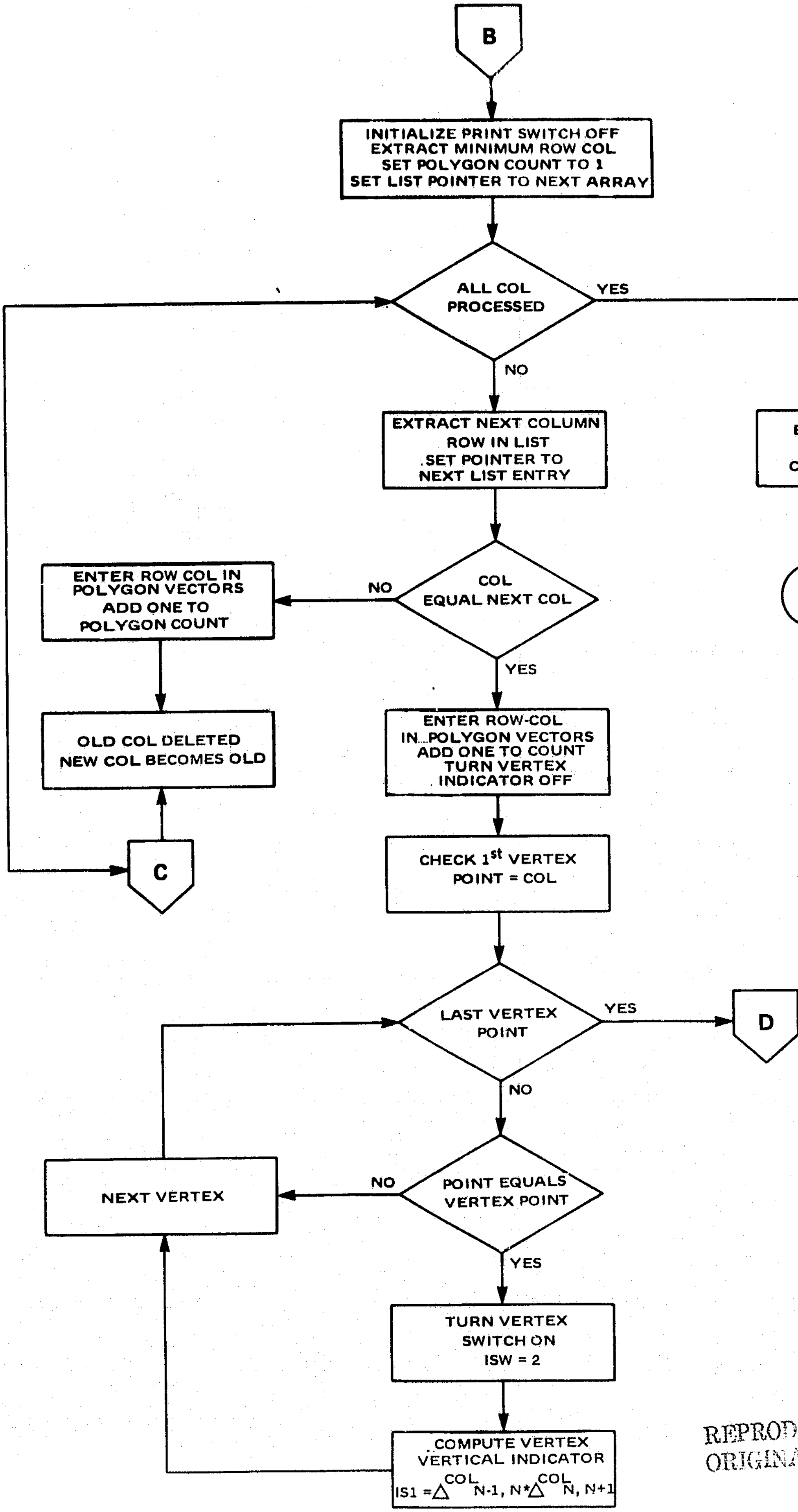


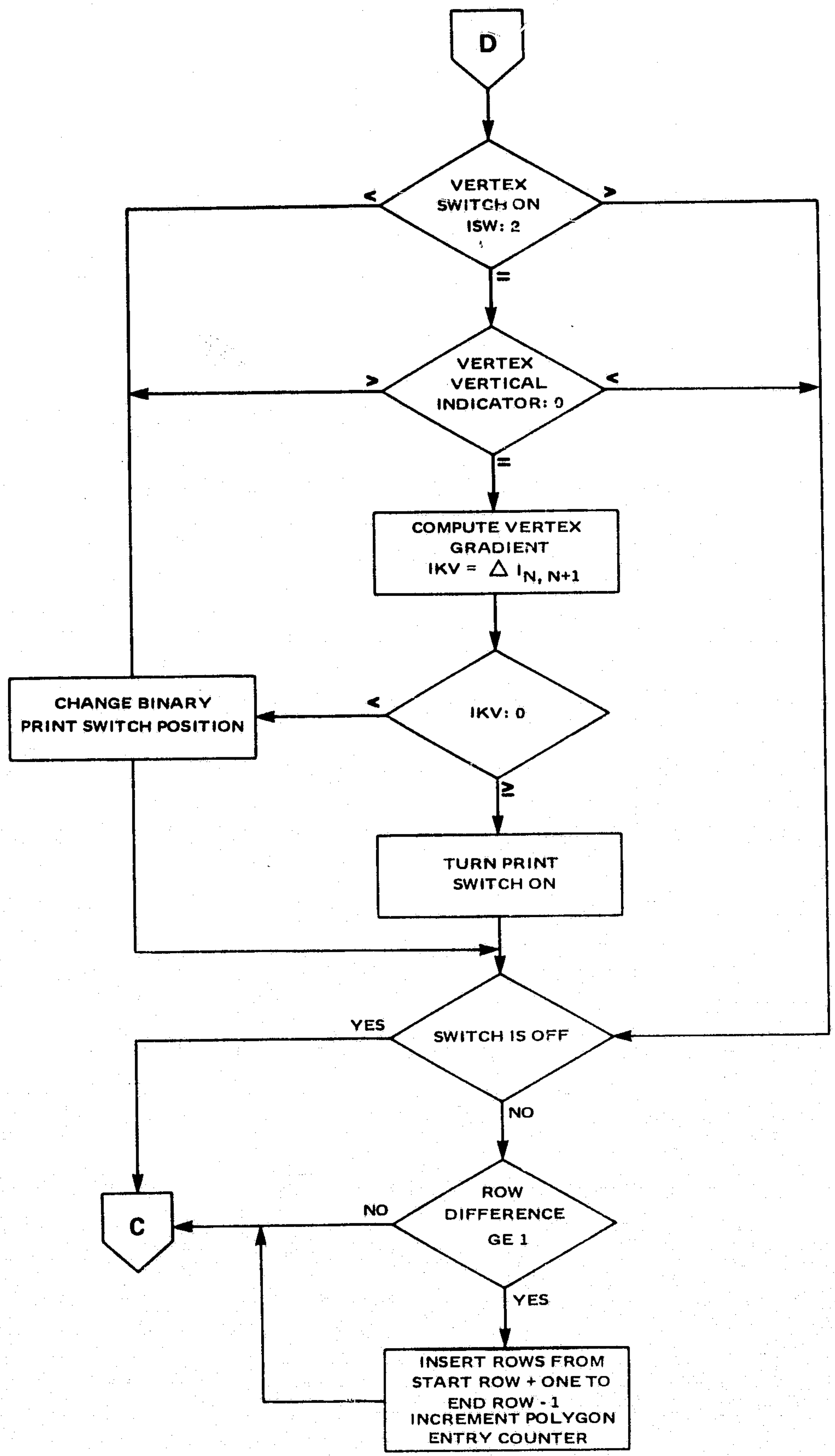

B
LEVEL 1 HAS OBSERVATION
NO
A
YES
COMPUTE CLOUD TYPE INDEX (KODE)
DETERMINE SMALLER OF TOTAL VS LEVEL AMOUNTS
ALL LEVELS COMPLETE
YES
RETURN
NO
LEVEL I REPORTED CLOUDS
NO
YES
COMPUTE TYPE & FRACTION COVER FOR LEVEL I

SUBROUTINE POLYGO

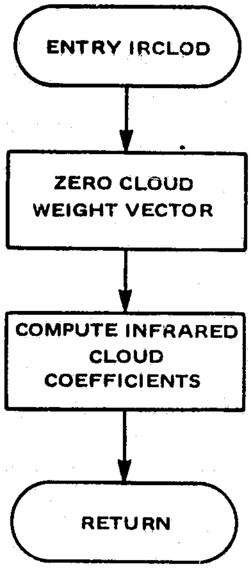



A
POINT TO FIRST LIST ELEMENT INITIALIZED END OF LIST
ALL BOUNDARY ELEMENTS PROCESSED
YES
B
NO
INITIALIZE LIST POINTER TO MINIMUM LIST ENTRY NEXT BOUNDARY COL
NEXT LIST ENTRY
INSERT IN LIST UPDATE PREVIOUS & PRESENT POINTERS
NO
LIST POINTER: MINIMUM LIST POINTER
<
COL: LIST COL
>
LAST LIST ENTRY
NO
YES
=
YES
UPDATE PREVIOUS MINIMUM COL LIST ENTRY
<
ROW: LIST ROW
>
UPDATE MAXIMUM COL LIST ENTRY
=
UPDATE MINIMUM COL POINTER JFLINK
UPDATE OLD MAXIMUM POINTER

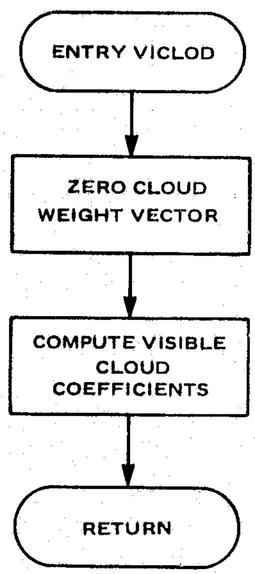

B
INITIALIZE PRINT SWITCH OFF
EXTRACT MINIMUM ROW COL
SET POLYGON COUNT TO 1
SET LIST POINTER TO NEXT ARRAY
ALL COL PROCESSED
YES
NO
EXTRACT NEXT COLUMN ROW IN LIST
SET POINTER TO NEXT LIST ENTRY
ENTER LAST POINT IN POLYGON COL - ROW VECTORS
RETURN
COL EQUAL NEXT COL
NO
ENTER ROW COL IN POLYGON VECTORS
ADD ONE TO POLYGON COUNT
YES
ENTER ROW-COL IN POLYGON VECTORS
ADD ONE TO COUNT
TURN VERTEX INDICATOR OFF
OLD COL DELETED
NEW COL BECOMES OLD
C
CHECK 1st VERTEX POINT = COL
LAST VERTEX POINT
YES
D
NO
POINT EQUALS VERTEX POINT
NO
NEXT VERTEX
YES
TURN VERTEX SWITCH ON
ISW = 2
COMPUTE VERTEX VERTICAL INDICATOR
IS1 = △COL N-1, N*△COL N, N+1


D
VERTEX SWITCH ON ISW: 2
<
>
=
VERTEX VERTICAL INDICATOR: 0
>
<
=
COMPUTE VERTEX GRADIENT IKV = Δ I N, N+1
IKV: 0
<
≥
CHANGE BINARY PRINT SWITCH POSITION
TURN PRINT SWITCH ON
SWITCH IS OFF
YES
NO
ROW DIFFERENCE GE 1
NO
YES
C
INSERT ROWS FROM START ROW + ONE TO END ROW - 1 INCREMENT POLYGON ENTRY COUNTER

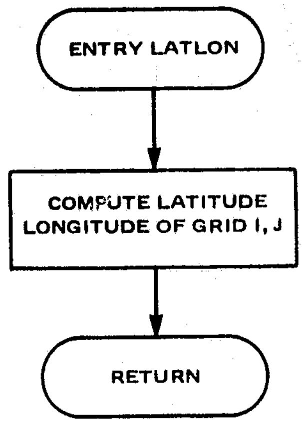
SUBROUTINE IRCLOD



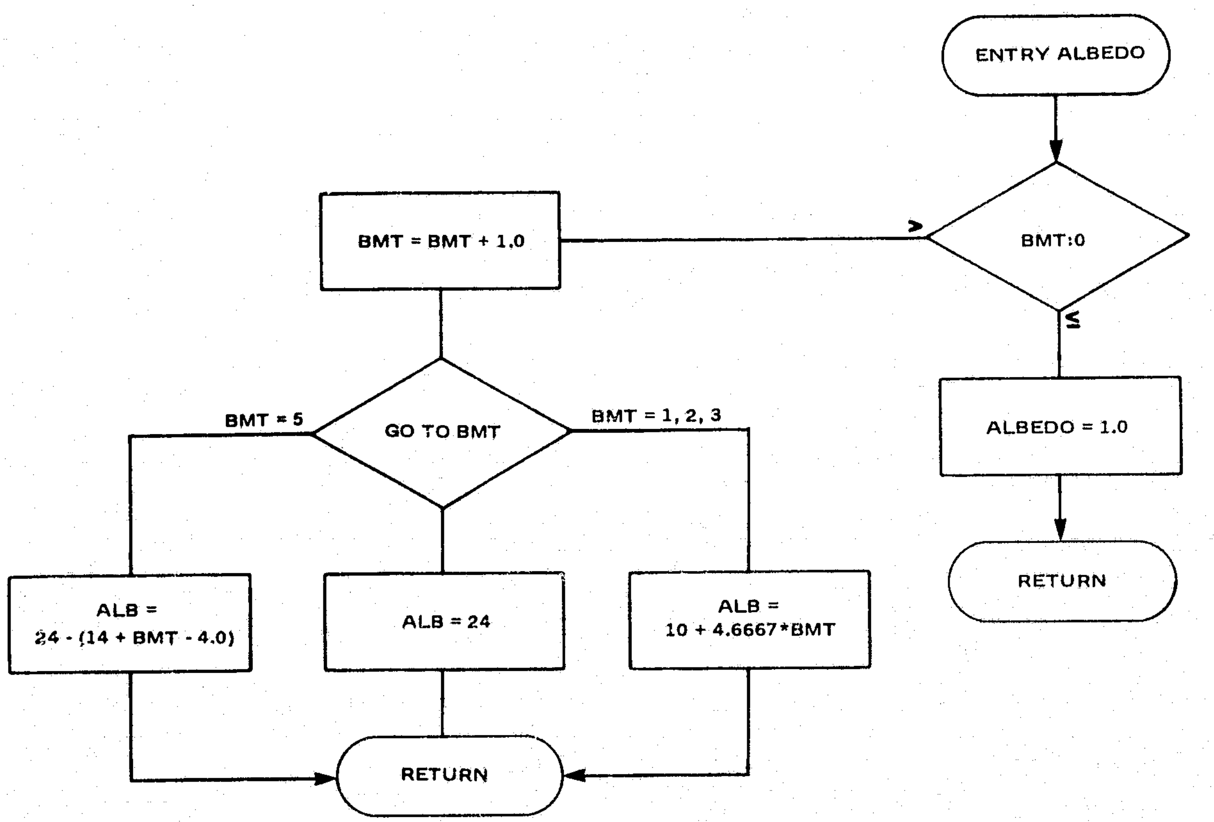
SUBROUTINE VICLOD



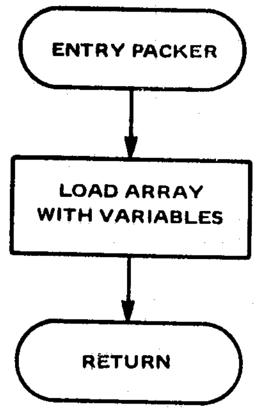
SUBROUTINE LATLON



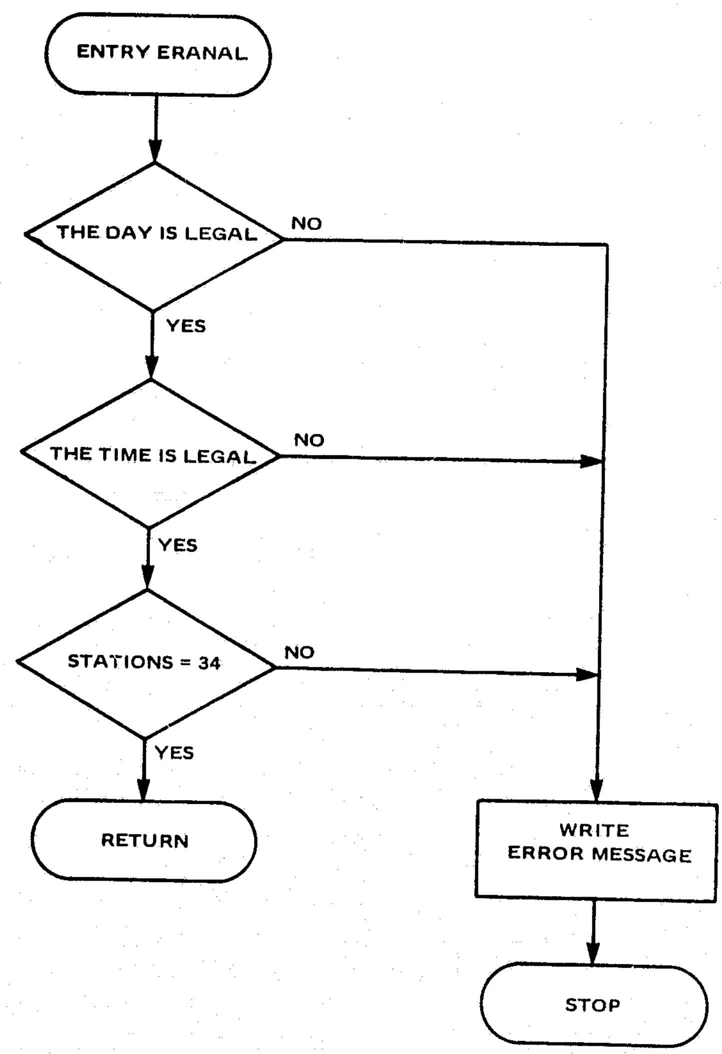
SUBROUTINE ALBEDO



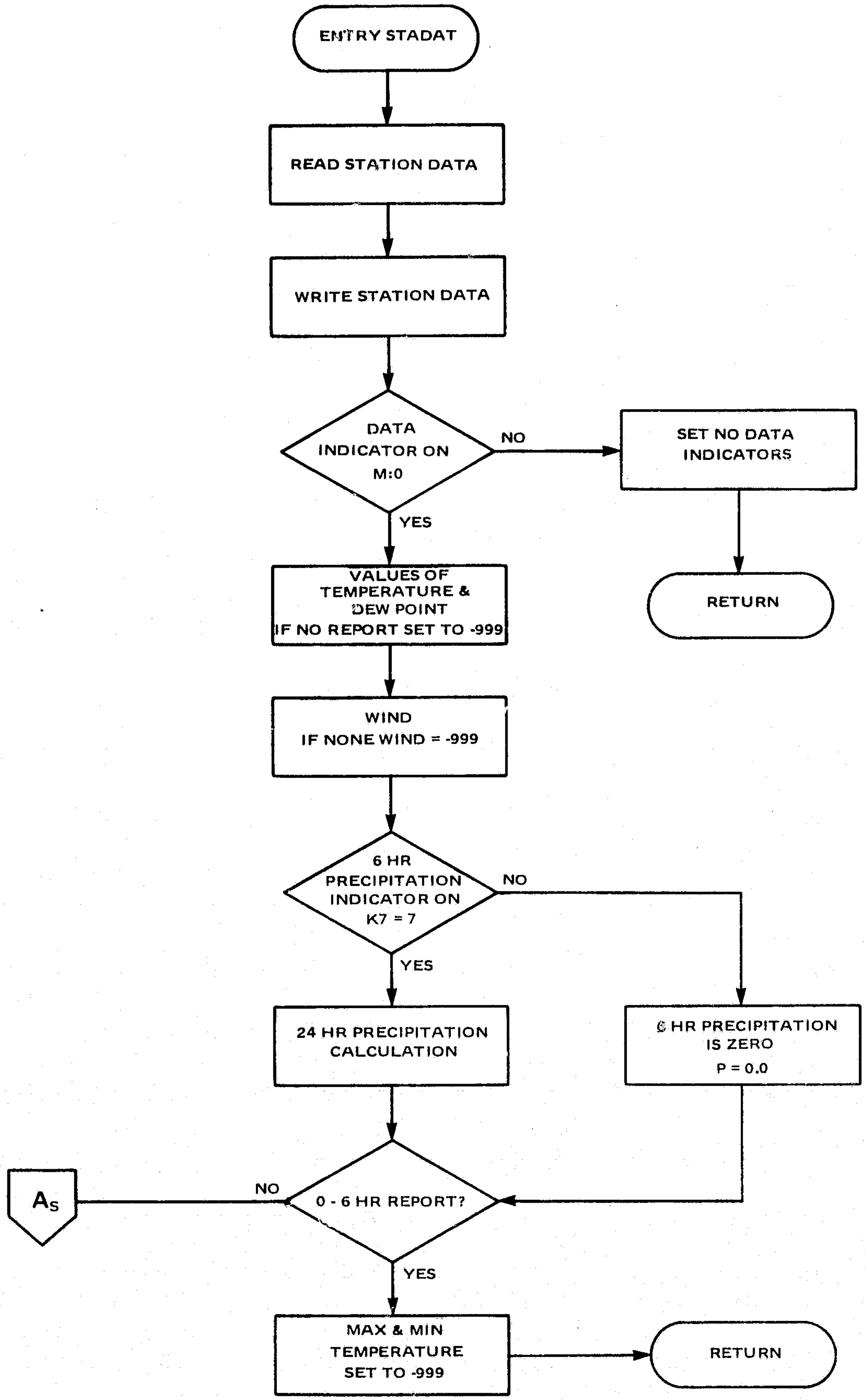
SUBROUTINE PACKER



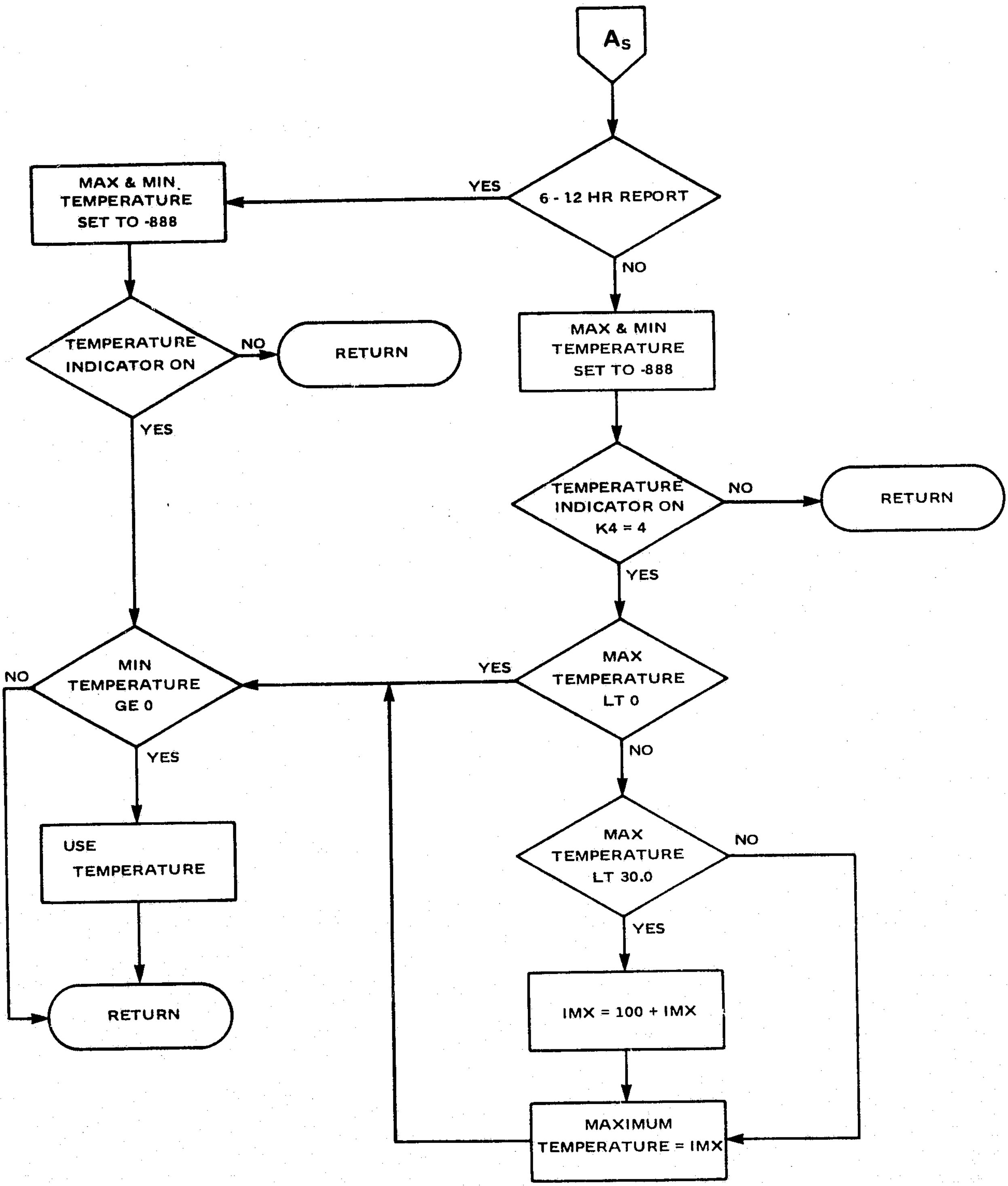
SUBROUTINE ERANAL



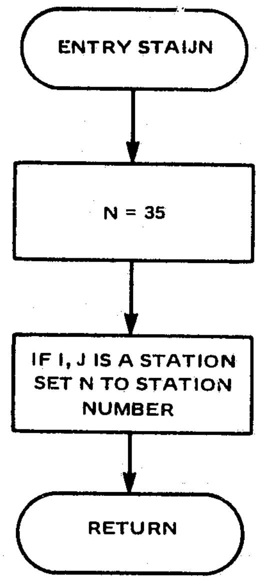
SUBROUTINE STADAT



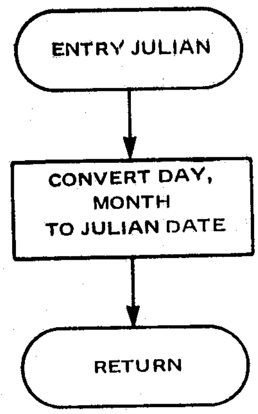
SUBROUTINE STADAT



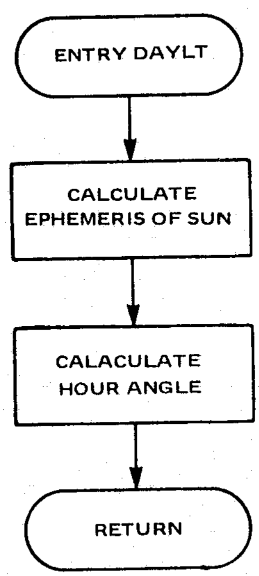
SUBROUTINE STAIJN



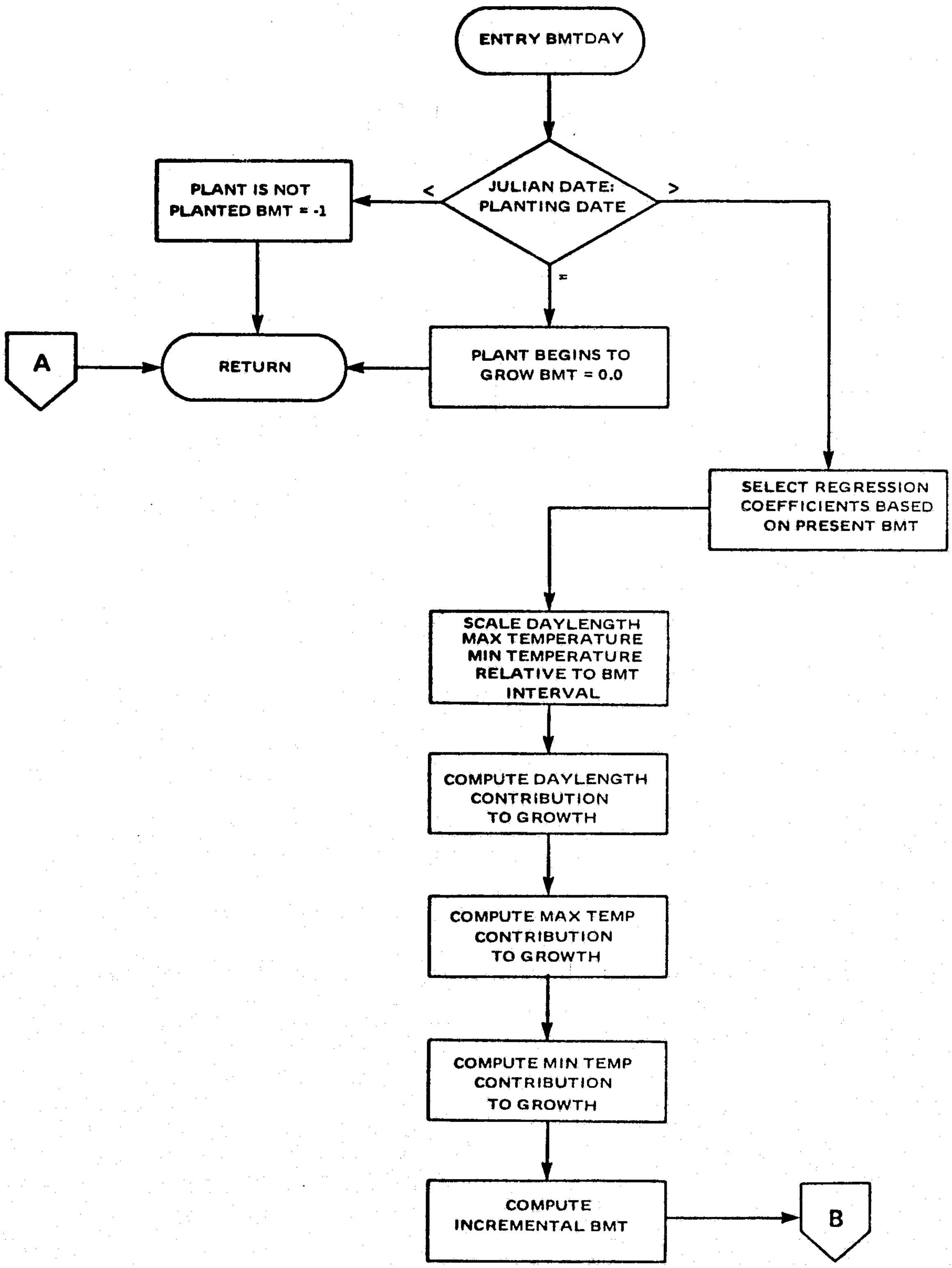
SUBROUTINE JULIAN



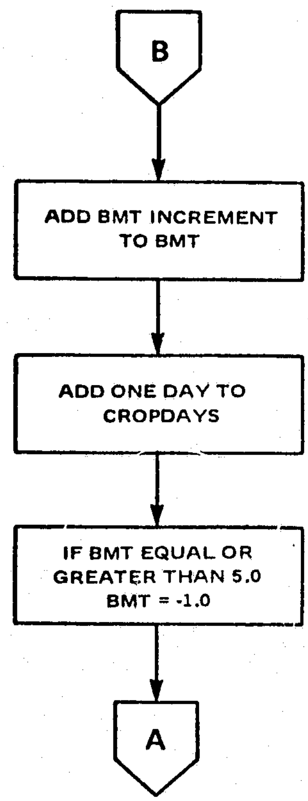
SUBROUTINE DAYLT



SUBROUTINE BMTDAY



SUBROUTINE BMTDAY



5.1.1.6 SOURCE CODE

```
C      THIS IS THE MAIN PROGRAM FOR PREPARING THE INPUT METEOROLOGICAL
C      PARAMETERS FOR THE EARTHSAT -LACIE WHEAT FORECAST SYSTEM
C      CODED BY R. SABATINI
       REAL*8 AMAPIJ(7,2,28,2)
       DIMENSION ICC(9),TA(35),TD(35),W(35),P(35),X(35),B(2),CV(7),CL(9,3
     @),XLA(11),XLO(11),D(6),IPEST(35)
     @,ICLO(35),ICTO(35),ISIG(35),TMX(35),TMN(35),ICTY(35,3),ITY(3)
       INTEGER*2 PLNDAT(27,28)
       INTEGER*2 IPTOT(27,28),    ISP(27,28,9),II(500), JJ(500),IPET(27,28
     @),IRNET(27,28),ITMAX(27,28),ITMIN(27,28),IPREC(27,28),IBMT(27,28)
       INTEGER*2 IP(6,27,28),ISTAS(6,27,28),ISOL(27,28)
       INTEGER*2 IPWK(27,28),IRLO(27,28)
       INTEGER*4 RA
       INTEGER*2 ARRAY(10)
       COMMON/MAP/AMAPIJ
       RA=0
C   READ OVERLAY MAP
       READ(9,898) AMAPIJ
  898 FORMAT(7A8)
C      THE FOLLOWING MAPS ARE PRINTED DAILY
C                                                 MAP NO. PARAMETER UNITS
C                                                    1   0-06GMT PREC MM*10
C                                                    2  06-12GMT PREC
C                                                    3  12-18GMT PREC
C                                                    4  18-24GMT PREC
C                                                    5  00-24GMT PREC
C                                                    6  00-24GMT NET RAD LY/DAY
C                                                    7  00-24GMT ETP MM*10
C                                                    8  00-24GMT TMAX DEG C*10
C                                                    9  00-24GMT TMIN DEG C*10
C      BMT IS MULTIPLIED BY 1000 WHEN TAPED         10  00-24GMT BMT*100
C                                                   11  00-24GMT SOL RAD LY/DAY
C                                                   12  TOTAL PREC FOR PERIOD (MM
C      C1...C10 ARE COEFFICIENTS FOR RAINFALL EQUATIONS
       READ(5,899) C1,C2,C3,C4,C5,C6,C7,C8,C9,C10
       WRITE(6,8990)C1,C2,C3,C4,C5,C6,C7,C8,C9,C10
8990   FORMAT(1H1,10F8.4)
899    FORMAT(10F8.4)
       NDAY=0
C      INITIALIZE WEEKLY OR PERIOD TOTAL PRECIPITATION
       DO 2102 I=1,27
       DO 2102 J=1,28
2102   IPWK(I,J)=0
C      NDAYS IS NO. OF DAYS DATA ON OLD TAPE
       READ(5,900) IFIRST,ILAST,JFIRST,JLAST,IDIS,JDIS,IEAST,NDAYS
     1 ,FMAX,FMIN
900    FORMAT(8I5,2F10.3)
       IF(FMAX.EQ.0.0) FMAX=3.
       IF(FMIN.EQ.0.0) FMIN=0.333
       IXF=1
       JXF=1
```

```
      IXL=ILAST-IFIRST+1
      JXL=JLAST-JFIRST+1
      WRITE(6,900)IXF,IXL,JXF,JXL,IDIS,JDIS
C     READ STATION ASSIGNMENT FROM TAPE
      DO 2001 I=1,28
      DO 2001 J=1,28
2001  READ(30,9000,END=2002) IX,JX,(ISTAS(K,I,J),IR(K,I,J),K=1,6),
     1PLNDAT(I,J),IBMT(I,J)
2002  CONTINUE
      REWIND 30
      IF(NDAYS.EQ.0) GO TO 999
C     READ OLD BMT FROM LAST DAY ON OLD TAPE
      CALL OPENAG
      IRA=NDAYS-1
      DO 1111 L=1,IRA
      CALL AGREAD(ARRAY)
      DO 1112 LL=1,756
      CALL AGREAD(ARRAY)
1112  CONTINUE
1111   CONTINUE
      CALL AGREAD(ARRAY)
      IYEAR=ARRAY(1)
      JD=ARRAY(2)
      IT=ARRAY(3)
      DO 1113 I=1,27
      DO 113 J=1,28
      CALL AGREAD(ARRAY)
      IBMT(I,J)=ARRAY(9)
113   CONTINUE
1113  CONTINUE
      CALL AGREAD(ARRAY)
1114  CONTINUE
 999  CONTINUE
      CALL AGOPEN
1     CONTINUE
      DO 1011 I=1,27
      DO 1011 J=1,28
      IRLO(I,J)=0
      IPET(I,J)=0
      ISOL(I,J)=0
      IRNET(I,J)=0
      IPTOT(I,J)=0
1011  CONTINUE
      P(35)=-99.
      MAP=0
      ISAT=0
C     READ CONTROL CARD FOR DAY INTERVAL.
 11   CONTINUE
      WRITE(6,2203)
2203  FORMAT('1')
      READ(5,900,END=99) IDAY,ITIME,KI    ,IDEL2,IRNO,IVNO,ITEST,NSTA
```

```
      CALL ERANAL (IDAY,ITIME,KI,IDEL2,NSTA)
      WRITE(6,900)IDAY,ITIME,KI    ,IDEL2,IRNO,IVNO,ITEST,NSTA
      ISAT=ISAT+ITEST
      IF(ITEST .EQ. 0) GO TO 3
      IF(ITEST .LT. 0) GO TO 99
      DO 101 I=1,27
      DO 101 J=1,28
      DO 101 N=1,9
  101 ISP(I,J,N)=0
C     READ SATELLITE CLOUD COVER
      WRITE(6,9007)
    2 READ(5,901) ID,IT,(ICC(N),N=1,9),K,(XLA(KK),XLO(KK),KK=1,K)
      WRITE(6,911)ID,IT,(ICC(N),N=1,9),K,(XLA(KK),XLO(KK),KK=1,K)
911   FORMAT(1X,I4,I5,10I1,9(F5.1,F6.1))
      IF(K.EQ.0) GO TO 3
C     MAKE WEST LONGITUDES NEGATIVE
      DO 21 I=1,K
21    XLO(I)=XLO(I)*FLOAT(IEAST)
901   FORMAT(I3,I4    ,10I1,9(F3.1,F4.1))
      XLA(KK+1)=XLA(1)
      XLO(KK+1)=XLO(1)
      NK=KK+1
      NPOL=1
      CALL POLYGO(NPOL,XLA,XLO,NK,II,JJ,NMAX)
      DO 1023K=1,NMAX
      I=II(K)-205
      J=JJ(K)-334
      IF (I.EQ. 1.AND.J.GE.27) GO TO 1023
      IF(II(K).EQ.223.AND.JJ(K).EQ.371) I=1
      IF(II(K).EQ.223.AND.JJ(K).EQ.371) J=27
      IF(II(K).EQ.211.AND.JJ(K).EQ.364) I=1
      IF(II(K).EQ.211.AND.JJ(K).EQ.364) J=28
C     TEST FOR CELL LOCATION IN OR OUT OF AREA OF INTEREST
      IF(I.GE.IXF.AND.I.LE.IXL.AND.J.GE.JXF.AND.J.LE.JXL) GO TO 1022
      GO TO 1023
1022  DO 102 N=1,9
      ISP(I,J,N)=ICC(N)
102   CONTINUE
1023  CONTINUE
      GO TO 2
    3 CONTINUE
      DO 110 KIK=1,KI
C     READ STATION DATA
      DO 5 ISTA=1,34
      CALL STADAT (X1,X2,X3,X4,ICL,ICT,ITY,ISG,X5,X6)
      IF(ITIME.EQ.6) GO TO 503
      IF(X5.EQ.-999.) X5=-888.
      IF(X6.EQ.-999.) X6=-888.
  503 TA(ISTA)=X1
      TD(ISTA)=X2
      W(ISTA)=X3
      P(ISTA)=X4
```

```
      ICLO(ISTA)=ICL
      ICTO(ISTA)=ICT
      ISIG(ISTA)=ISG
      IF(X5.EQ.-888.) GO TO 303
      TMX(ISTA)=X5
  303 IF(X6.EQ.-888.) GO TO 403
      TMN(ISTA)=X6
  403 DO 203 I=1,3
  203 ICTY(ISTA,I)=ITY(I)
    5 CONTINUE
      DO 104 I=1,27
      DO 104 J=1,28
      IX=I+205
      JX=J+334
      IF(I.EQ. 1.AND.J.EQ.28) IX=211
      IF(I.EQ. 1.AND.J.EQ.27) JX=371
      IF(I.EQ. 1.AND.J.EQ.27) IX=223
      IF(I.EQ. 1.AND.J.EQ.28) JX=364
C     INTERPOLATE FOR TEMPERATURE
C     INTERPOLATE FOR DEW POINT
C     INTERPOLATE FOR WIND
      DO 105 N=1,6
      IDIST=IR(N,I,J)
105    D(N)=IDIST
      DO 107 INDEX=1,3
      DO 106 N=1,6
       K=ISTAS(N,I,J)
      IF(INDEX.EQ.1) X(N)=TA(K)
      IF(INDEX.EQ.2) X(N)=TD(K)
106   IF(INDEX.EQ.3) X(N)=W(K)
      IF(INDEX.EQ.1) CALL INTERP(X,D,TEMP)
      IF(INDEX.EQ.2) CALL INTERP(X,D,TDEW)
      IF(INDEX.EQ.3) CALL INTERP(X,D,WIND)
107   CONTINUE
      IF(ITEST .NE. 0) GO TO 8
C     IF NO SATELLITE DATA AVAILABLE (ITEST=0) ASSIGN CLOUD COVER OF NEARES
C     STATION TO I,J, OTHERWISE USE AVG SAT CLOUD COVER.
      DO 307 N=1,6
      K=ISTAS(N,I,J)
      DO 207 IK=1,3
  207 ITY(IK)=ICTY(K,IK)
      CALL CLODFI(ICLO(K),ICTO(K),ITY,CL)
      IF(CL(1,1)) 307,407,407
  307 CONTINUE
      CL(1,1)=0.0
  407 CONTINUE
      GO TO 10
C     ASSIGN AVG SAT CLOUD COVER TO I,J: USE VISIBLE DATA, IF NOT AVAILABLE
C     IR DATA.
    8 CONTINUE
      IF(IVNO .NE. 0) GO TO 9
```

```
      I1=ISP(I,J,8)
      B(1)=FLOAT(I1)/FLOAT(IRNO)
      I2=ISP(I,J,9)
      B(2)=FLOAT(I2)/FLOAT(IRNO)
      CALL IRCLOD(B,CL)
      GO TO 10
    9 DO 108 N=1,7
      IN=ISP(I,J,N)
  108 CV(N)=FLOAT(IN)/FLOAT(IVNO)
      CALL VICLOD(CV,CL)
   10 CONTINUE
C     CALCULATE ALBEDO FROM BMT. RETRIEVE PREVIOUS DAY BMT FROM DISK.
      IB=IBMT(I,J)
      BMT=FLOAT(IB)/1000.
      CALL ALBEDO(BMT,ALB)
C     CALCULATE RNET,ETP FOR INTERVAL OF TIME COVERED BY STATION REPORTS IDEL
      ID=IDAY
      CALLETPCAL(IDEL2,ID,IX,JX,ITIME,TEMP,TDEW,WIND,CL,ALB,ETP,RNT,SOL,
     1 RLONG)
      IF(SOL.LT.0.0) CALL ABED
      IRNT=RNT+0.5
      IETP=ETP*10.+0.5
      ISL=SOL+0.5
      IRL=RLONG+0.5
      IRLO(I,J)=IRLO(I,J)+IRL
      ISOL(I,J)=ISOL(I,J)+ISL
      IPET(I,J)=IPET(I,J)+IETP
      IRNET(I,J)=IRNET(I,J)+IRNT
  104 CONTINUE
      IF(IT.EQ.3.OR.IT.EQ.9.OR.IT.EQ.15.OR.IT.EQ.21) GO TO 110
C     CALCULATE 6 HR PRECIPITATION
C     IF NO SATELLITE DATA AVAILABLE FOR DAY (ISAT=0), INTERPOLATE
C     PRECIPITATION FROM GROUND REPORTS.
C     CALCULATE RAINFALL FOR EACH CELL BY A SATELLITE ESTIMATE SCALED BY A
C     FACTOR DETERMINED BY RATIO OF ACTUAL TO SAT ESTIMATE AT PRECIPITATION
C     REPORTING STATIONS.
      IYEAR=75
C     THE NEXT STATEMENT WRITES ON TAPE THE YEAR DAY AND TIME FOR 6HOUR
C     PRECIPITATION ESTIMATE AND OBSERVATION WHEN AVAILABLE
C     WRITE(10,9003) IYEAR,IDAY,ITIME
      CALL PACKER(ARRAY,IYEAR,IDAY,ITIME,RA,RA,RA,RA,RA,RA)
      CALL ERRWRT(ARRAY)
      IF(ITEST.EQ.0) GO TO 98
      DO 1065 I=1,27
      DO 1065 J=1,28
 1065 IPREC(I,J)=-99
      SP=0.0
      GP=0.0
      DO 1066 N=1,NSTA
      IF(P(N) .LT..0) GO TO 1066
      CALL STANIJ(N,IX,JX)
      I=IX-205
      J=JX-334
```

```
      IF(I.GE.IXF.AND.I.LE.IXL.AND.J.GE.JXF.AND.J.LE.JXL) GO TO 1050
      GO TO 1066
 1050 CONTINUE
      GP=GP+P(N)
C     USE FREGRESSION FORMULA FOR ESTIMATING PRECIP (IN MM) FROM CLOUD COVER
C     FIGHTS).
      CN=ISP(I,J,1)
      CC=ISP(I,J,2)
      CU=ISP(I,J,3)
      B1=ISP(I,J,8)
      B2=ISP(I,J,9)
      IF(IVNO.NE.0.AND.IRNO.NE.0)SP=SP+C1*CN+C2*CC+C3*CU+C4*B1+C5*B2
      IF(IVNO.EQ.0)SP=SP+C9*B1+C10*B2
      IF(IRNO.EQ.0) SP=SP+C6*CN+C7*CC+C8*CU
 1066 CONTINUE
      IF(SP.EQ.0.0) FACTOR=1.
      IF(SP.GT.0.0) FACTOR=GP/SP
      IF(FACTOR.GT.FMAX) FACTOR=FMAX
      IF(FACTOR.LT.FMIN) FACTOR=FMIN
C     USE REGRESSION  FORMULA TIMES FACTOR TO CALCULATE PRECIPITATION AT EACH
      DO 1077 I=1,27
      DO 1077 J=1,28
      CN=ISP(I,J,1)
      CC=ISP(I,J,2)
      CU=ISP(I,J,3)
      B1=ISP(I,J,8)
      B2=ISP(I,J,9)
      IF(IVNO.NE.0.AND.IRNO.NE.0)PREC=FACTOR*(C1*CN+C2*CC+C3*CU+C4*B1+C5
     1*B2)
      IF(IVNO.EQ.0)PREC=FACTOR*(C9*B1+C10*B2)
      IF(IRNO.EQ.0)PREC=FACTOR*(C6*CN+C7*CC+C8*CU)
      IPREC(I,J)=PREC*10.
      IX=I+205
      JX=J+334
      CALL STAIJN(IX,JX,N)
      IPOBS= P(N)*10.
      IDUMMY=IPREC(I,J)
      IF(IPOBS.GE.0)  IPREC(I,J)=IPOBS
      IF(IPOBS.GE.0)  IPOBS=IDUMMY
      IPTOT(I,J)=IPTOT(I,J)+IPREC(I,J)
      CALL PACKER(ARRAY,IX,JX,IPOBS,RA,RA,RA,RA,RA,RA)
      ARRAY(4)=IPREC(I,J)
      CALL ERRWRT(ARRAY)
 1077 CONTINUE
      MAP=MAP+1
      CALL PPINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IPREC,ID,ITIME,MAP)
      GO TO 1080
   98 CONTINUE
C     INTERPOLATE PRECIPITATION FROM GROUND REPORTS.
      DO 1078 I=1,27
      DO 1078 J=1,28
      IX=I+205
```

```
      JX=J+334
      DO 1079 N=1,6
1079  D(N)=IR(N,I,J)
      DO 10777N=1,6
      K=ISTAS(N,I,J)
10777 X(N)=P(K)*10.
C     SUBROUTINE INTERP INTERPOLATES PRECIPITATION FROM GROUND REPORTS.
      CALL INTERP(X,D,PINT)
      IPREC(I,J)=PINT
      IX=I+205
      JX=J+334
      CALL STAIJN(IX,JX,N)
      IPOBS= P(N)*10.
      CALL PACKER(ARRAY,IX,JX,IPOBS,RA,RA,RA,RA,RA,RA)
      ARRAY(4)=IPREC(I,J)
      CALL ERRWRT(ARRAY)
      IF(IPOBS.GE.0) IPREC(I,J)=IPOBS
      IPTOT(I,J)=IPTOT(I,J)+IPREC(I,J)
 1078 CONTINUE
      MAP=MAP+1
      IT=ITIME
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IPREC,ID,IT,MAP)
1080  CONTINUE
  110 CONTINUE
      IF(ITIME.NE.24) GO TO 11
      IT=24
      MAP=MAP+1
9005  FORMAT(1X,' IXF-JXF-IXL-JXL-IDIS-JDIS',6I6)
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IPTOT,ID,IT,MAP)
      MAP=MAP+1
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IRNET,ID,IT,MAP)
      MAP=MAP+1
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IPET ,ID,IT,MAP)
C     INTERPOLATE TMAX AND TMIN AT EACH I,J.
      DO 1033 I=1,27
      DO 1033 J=1,28
      IX=I+205
      JX=J+334
      IF(I.EQ. 1.AND.J.EQ.28) JX=364
      IF(I.EQ. 1.AND.J.EQ.28) IX=211
      IF(I.EQ. 1.AND.J.EQ.27) JX=371
      IF(I.EQ. 1.AND.J.EQ.27) IX=223
C     INTERPOLATE FOR TMIN
C     INTERPOLATE FOR TMAX.
      DO 1044 N=1,6
1044  D(N)=IR(N,I,J)
      DO 1055 INDEX=1,2
      DO 10666N=1,6
      K=ISTAS(N,I,J)
      IF(INDEX.EQ.1) X(N)=TMX(K)
10666 IF(INDEX.EQ.2) X(N)=TMN(K)
```

```
      IF(INDFX.EQ.1) CALL INTERP(X,D,TMAX)
      IF(INDEX.EQ.2) CALL INTERP(X,D,TMIN )
1055  CONTINUE
C     CALCULATE NFW BMT AND WRITF IT ON TAPF
C     CALCULATE DAYLENGTH
      CALL LATLON(IX,JX,XLATID,XLONG)
      CALL DAYLT(XLATID,IDAY,DAYLNT)
      IB=IBMT(I,J)
      BMT=FLOAT(IB)/1000.
      CALL BMTDAY(DAYLNT,BMT,BMTNEW,IDAY,PLNDAT(I,J),TMAX,TMIN)
      IBMT(I,J)=BMTNEW*1000.
      ITMAX(I,J)=5./9.*(TMAX-32.)*10.+0.5
      ITMIN(I,J)=5./9.*(TMIN-32.)*10.+0.5
1033  CONTINUE
C     THE NEXT STATEMENT WRITES ON TAPE THE DAY AND TIME=24
C     FOR WHICH 24 HOUR VALUES OF METEOR PARAMETERS HAVE BEEN CALCULATED
      CALL PACKER(ARRAY,IYEAR,ID,IT,RA,RA,RA,RA,RA,RA)
      ARRAY(10)=900
      CALL ERRWRT(ARRAY)
      CALL METWRT(ARRAY)
      ARRAY(10)=ID
C     THE 2000 DO LOOP WRITES ON TAPE THE DAILY VALUES OF THE METEOR
C     PARAMETERS FOR EACH I J
      DO 2000 I=1,27
      DO 2000 J=1,28
      IX=I+205
      JX=J+334
      CALL PACKER(ARRAY,IX,JX,RA,RA,RA,RA,RA,RA,RA)
      ARRAY(3)=IPTOT(I,J)
      ARRAY(4)=IPET(I,J)
      ARRAY(5)=IRNET(I,J)
      ARRAY(6)=ISOL(I,J)
      ARRAY(7)=ITMAX(I,J)
      ARRAY(8)=ITMIN(I,J)
      ARRAY(9)=IBMT(I,J)
      CALL ERRWRT(ARRAY)
      CALL METWRT(ARRAY)
      IPWK(I,J)=IPWK(I,J)+IPTOT(I,J)
2000   CONTINUE
      NDAY=NDAY+1
      MAP=MAP+1
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,ITMAX,ID,IT,MAP)
      MAP=MAP+1
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,ITMIN,ID,IT,MAP)
      MAP=MAP+1
C     SCALE DOWN BMT TO *100 FROM *1000 BEFORE PRINTING USE IPET(I,J)=IBMT
      DO 2100 I=1,27
      DO 2100 J=1,28
      IB=IBMT(I,J)
      IB=IB/10
2100  IPET(I,J)=IB
```

```
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IPET ,ID,IT,MAP)
      MAP=MAP+1
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,ISOL ,ID,IT,MAP)
9000  FORMAT(2I3,14I5)
9003  FORMAT(3I5)
9004  FORMAT(4I5)
9006  FORMAT(2I3,7I5)
9007  FORMAT(1H0,' DAY  GMT CLOUDS  K LATITUDES-LONGITUDES(W) OF CLOUD
     1POLYGON VERTICES')
      GO TO 1
   99 CONTINUE
C     SCALE DOWN PERIOD PRECIP BY 10 AND PRINT PERIOD PRECIP
      DO 2101 I=1,27
      DO 2101 J=1,28
      IB=IPWK(I,J)
      IB=IB/10
2101   IPWK(I,J)=IB
      MAP=12
      CALL PRINT(IXF,JXF,IXL,JXL,IDIS,JDIS,IPWK,ID,NDAY,MAP)
      END
```

```
      SUBROUTINE PRINT(IXF,JXF,IXL,JXL, IDIS,JDIS,IX,ID,IT,N)
      REAL*8 AMAPIJ(7,2,28,2)
      INTEGER*2 ICO(27),IX(27,28)
      COMMON/MAP/AMAPIJ
      IXFF=IXF
      ISHEET=  1
      NDAY=IT
 4    CONTINUE
      WRITE(6,103)
      WRITE(6,104)
      IF(N.EQ.12) IT=24
      WRITE(6,1100) ISHEET,ID,IT,N
      IF(N.EQ.1) WRITE(6,1101)
      IF(N.EQ.2) WRITE(6,1102)
      IF(N.EQ.3) WRITE(6,1103)
      IF(N.EQ.4) WRITE(6,1104)
      IF(N.EQ.5) WRITE(6,1105)
      IF(N.EQ.6) WRITE(6,1106)
      IF(N.EQ.7) WRITE(6,1107)
      IF(N.EQ.8) WRITE(6,1108)
      IF(N.EQ.9) WRITE(6,1109)
      IF(N.EQ.10)WRITE(6,1110)
      IF(N.EQ.11)WRITE(6,1111)
      IF(N.EQ.12) WRITE(6,1113) NDAY
1101  FORMAT(1H+,87X,' 00-06 GMT PREC MM*10')
1102  FORMAT(1H+,87X,' 06-12 GMT PREC MM*10')
1103  FORMAT(1H+,87X,' 12-18 GMT PREC MM*10')
1104  FORMAT(1H+,87X,' 18-24 GMT PREC MM*10')
1105  FORMAT(1H+,87X,' 00-24 GMT PREC MM*10')
1106  FORMAT(1H+,87X,' 00-24 GMT NET RAD LY/DAY')
1107  FORMAT(1H+,87X,' 00-24 GMT ETP MM*10')
1108  FORMAT(1H+,87X,' 00-24 GMT TMAX DEG C*10')
1109  FORMAT(1H+,87X,' 00-24 GMT TMIN DEG C*10')
1110  FORMAT(1H+,87X,' 00-24 GMT BMT*100')
1111  FORMAT(1H+,87X,' 00-24 GMT SOLAR RAD LY/DAY')
1112  FORMAT(1H+,87X,' 00-24 GMT NET LW RAD LY/DAY')
1113  FORMAT(1H+,87X,' TOTAL PRECIP (MM)',I3,' DAYS')
1100    FORMAT(1X,'HOR COORD = I VERT COORD = J',20X,'PAGE',I2,'  DAY',
     1 I3,'  TIME',I4,' GMT  ',' MAP',I3)
      IXLL=IXFF+26
      IF(IXLL.GT.IXL)       IXLL=IXL
      DO 1 IP=IXFF,IXLL
      IPP=IP+205
1     ICO(IP)=IPP
      WRITE(6,100) (ICO(IP),IP=IXFF,IXLL)
      JF=JXF
      JL=JXL
      DO 2 JP=JF,JL
      JPP=JP+334
C     WRITE(6,102)
      WRITE(6,101) JPP,(IX(IP,JP),IP=IXFF,IXLL)
      WRITE(6,105)(((AMAPIJ(I,L,JP,M),I=1,7),M=1,2),L=1,2)
2     CONTINUE
```

```
      IF(IXLL.EQ.IXL)   GO TO 3
      IXFF=IXLL+1
      ISHEET=ISHEET+1
      GO TO 4
  100 FORMAT(1H0,3X,27I4/3X,'****')
  101 FORMAT(1H ,I3,27I4)
102   FORMAT(1H0)
 103  FORMAT('1',50X,'EARTHSAT')
 104  FORMAT(43X,'DAILY WEATHER DIAGNOSTIC')
  105 FORMAT(14A8/14A8)
3     RETURN
      END
```

```
      SUBROUTINE STANIJ(N,I,J)
C     ASSIGNS I,J TO STATION N WHERE N=1 TO 29.
      I=206
      J=335
      IF(N .EQ. 1) I=235
      IF(N .EQ. 1) J=349
      IF(N .EQ. 2) I=225
      IF(N .EQ. 2) J=354
      IF(N .EQ. 3) I=232
      IF(N .EQ. 3) J=356
      IF(N .EQ. 4) I=216
      IF(N .EQ. 4) J=354
      IF(N .EQ. 5) I=224
      IF(N .EQ. 5) J=357
      IF(N .EQ. 6) I=233
      IF(N .EQ. 6) J=358
      IF(N .EQ. 7) I=223
      IF(N .EQ. 7) J=360
      IF(N .EQ. 8) I=226
      IF(N .EQ. 8) J=363
      IF(N .EQ. 9) I=226
      IF(N .EQ. 9) J=360
      IF(N .EQ. 10) I=229
      IF(N .EQ. 10) J=361
      IF(N .EQ. 11) I=217
      IF(N .EQ. 11) J=363
      IF(N .EQ. 12) I=206
      IF(N .EQ. 12) J=340
      IF(N .EQ. 13) I=210
      IF(N .EQ. 13) J=339
      IF(N .EQ. 14) I=214
      IF(N .EQ. 14) J=342
      IF(N .EQ. 15) I=219
      IF(N .EQ. 15) J=344
      IF(N .EQ. 16) I=222
      IF(N .EQ. 16) J=350
      IF(N .EQ. 17) I=226
      IF(N .EQ. 17) J=347
      IF(N .EQ. 18) I=229
      IF(N .EQ. 18) J=351
      IF(N .EQ. 19) I=232
      IF(N .EQ. 19) J=351
      IF(N .EQ. 20) I=209
      IF(N .EQ. 20) J=346
      IF(N .EQ. 21) I=210
      IF(N .EQ. 21) J=350
      IF(N .EQ. 22) I=228
      IF(N .EQ. 22) J=344
      IF(N .EQ. 23) I=230
      IF(N .EQ. 23) J=344
      IF(N .EQ. 24) I=221
      IF(N .EQ. 24) J=343
      IF(N .EQ. 25) I=220
```

```
IF(N .EQ. 25) J=339
IF(N .EQ. 26) I=215
IF(N .EQ. 26) J=337
IF(N .EQ. 27) I=211
IF(N .EQ. 27) J=335
IF(N .EQ. 28) I=207
IF(N .EQ. 28) J=334
IF(N.EQ.29) I=209
IF(N.EQ.29) J=360
IF(N.EQ.30) I=213
IF(N.EQ.30) J=367
IF(N.EQ.31) I=221
IF(N.EQ.31) J=369
IF(N.EQ.32) I=225
IF(N.EQ.32) J=372
IF(N.EQ.33) I=227
IF(N.EQ.33) J=371
IF(N.EQ.34) I=208
IF(N.EQ.34) J=363
RETURN
END
```

```
      SUBROUTINE INTERP(XN,XMULT,VALUE)
      DIMENSION XN(6),XMULT(6)
      NC=0
      VALUE=0.0
      DEN=0.0
      DO 1 K=1,6
      X=XN(K)
      IF(X.LE.-888.) GO TO 1
      XM=XMULT(K)
      IF (XM.LT.0.0) GO TO 2
      DEN=DEN+XM/1000.
      VALUE=VALUE+X*XM/1000.
      NC=NC+1
      IF(NC.EQ.3) GO TO 2
1     CONTINUE
2     IF(DEN.EQ.0.0)     VALUE=-999.
      IF(DEN.EQ.0.0) GO TO 3
      VALUE=VALUE/DEN
      RETURN
3     RETURN
      END
```

```
      SUBROUTINE ETPCAL(IDEL2,JDAY,IA,JA,ITIME,TEMP,TDEW,WIND,CLODAM,ALB
     1 ,ETP,RNET,RSCR,RNLW)
      DIMENSION CLODAM(9,3),CLFACS(9,3),CLFACL(9,3),FACTOR(2)
      DATA CLFACS/.34,.23,.15,.34,.34,.25,.30,.34,.12,
     1            .41,.17,4*.51,.43,.43,.51,
     2            .84,.82,.81,.84,5*.81/
      DATA CLFACL/.20,.22,.24,.20,.20,.24,.22,.20,.24,
     1            .20,.24,4*.17,.18,.18,.17,
     2            .04,.06,.08,.04,5*.08/
      AMTSOL=0.0
      FACSOL=0.0
      FACLNG=0.0
         DO 40 J=1,3
            DO 20 I=1,9
            IF(CLODAM(I,J).EQ.0.) GO TO 20
            AMTSOL=AMTSOL+CLODAM(I,J)
            FACSOL=FACSOL+CLODAM(I,J)*CLFACS(I,J)
            FACLNG=FACLNG+CLODAM(I,J)*SQRT(CLFACL(I,J))
   20       CONTINUE
   40    CONTINUE
         FACTOR(1)=FACSOL+1.0-AMTSOL
         FACTOR(2)=FACLNG**2
      IF(ALB.LT.1.) GO TO 50
      IF(TDEW.GT.TEMP) TDEW=TEMP
   50 CALL LATLON(IA,JA,ALAT,ALON)
      JTIME=ITIME
      CALL ETPINT(IDEL2,JDAY,ALAT,ALON,JTIME,TEMP,TDEW,WIND,FACTOR,ALB,
     1            ETP,RNET,RSCR,RNLW)
      RETURN
      END
```

```
      SUBROUTINE ETPINT(IDT,IDAY,ALAT,ALON,ITIME,TEMP,TDEW,WIND,FAC,ALB,
     1  ETP,RNET,RSOL,RNLW)
C
C    **  ENTER WITH ALBEDO AS PERCENTAGE 1 TO 100 WHEN TDEW IS
C    **  THE ACTUAL DEW POINT TEMPERATURE
C    **  ENTER ALBEDO AS A FRACTION 0 TO 1 WHEN TDEW REPRESENTS
C    **  REPRESENTS RELATIVE HUMIDITY  0 TO 100
C     ***
C     *  THIS SUBROUTINE CALCULATES POTENTIAL EVAPOTRANSPIRATION
C     *  (ETP) AND NET RADIATION (RNET) FOR GIVEN TIME INTERVAL (HOURS)
C     *  ASSUMES THAT THE ATMOSPHERIC CONDITIONS (TEMPERATURE,
C     *  HUMIDITY, WIND, CLOUDS) ARE CONSTANT DURING THE INTERVAL,
C     *  BUT ACCOUNTS FOR THE VARYING SUN ANGLE.
C     ***
C
      DIMENSION FAC(2)
C
C     ***
C     *  FUNCTION DEFINING SATURATION VAPOR PRESSURE OVER WATER.
C     ***
C
      E(T)=10.**(-7.90298*(373./T-1.)+5.02808*ALOG10(373./T)
     1  -1.3816E-7*(10.**(11.344*(1.-T/373.))-1.)
     2  +8.1328E-3*(10.**(-3.49149*(373./T-1.))-1.)+ALOG10(1013.))
C     ***
C     *  INPUTS FROM CALL:
C     *     IDT - TIME INTERVAL OF INTEGRATION (HOURS)
C     *     IDAY - JULIAN DAY
C     *     ALAT,ALON - LATITUDE, LONGITUDE (DEGREES, POSITIVE N & E).
C     *     ITIME - GREENWICH MEAN TIME AT MIDPOINT OF INTERVAL (HOURS)
C     *     TEMP - TEMPERATURE (DEG. C).
C     *     TDEW - DEW POINT TEMPERATURE (DEG. C).
C     *     WIND - WIND SPEED (KNOTS).
C     *     FAC(1) - EFFECTIVE TRANSMISSIVITY OF CLOUD FIELD TO SOLAR
C     *                RADIATION.
C     *     FAC(2) - EFFECTIVE OPACITY OF CLOUD FIELD TO LONGWAVE
C     *                RADIATION.
C     *     ALB - ALBEDO SEE NOTE AT TOP
C     ***
C
      PI=3.141593
      SIG=8.132E-11
      SLAT=SIN(ALAT*PI/180.)
      CLAT=COS(ALAT*PI/180.)
      DAY=IDAY
      DT=IDT
C
C     ***
C     *  SOLAR DECLINATION ANGLE.
C     ***
      SDEC=23.5*PI/180.*SIN(2.*PI*( DAY-80.)/365.)
      SDEL=SIN(SDEC)
      CDEL=COS(SDEC)
```

```
C
C      ***
C      *  DEPARTURE OF LOCAL SUN TIME FROM GMT (HOURS).
C      ***
      DELT=ALON/15.
C
C      ***
C      *  CONVERT DEG. C TO DEG. K.
C      ***
      TA=TEMP+273.
      TD=TDEW
      IF(ALB.GT.1.)  TD=TDEW+273.
C
C         ***
C         *  VAPOR PRESSURE: SATURATION; ACTUAL; SLOPE OF CURVE.
C         ***
         ESAT=E(TA)
      IF(ALB.LE.1.) EAIR=ESAT*TD/100.
      IF(ALB.GT.1.) EAIR=E(TD)
      IF(ALB.LE.1.) ALB=100.*ALB
         DLTA=(ESAT/TA**2)*(6790.5-5.02808*TA+4916.8*10.**(-0.0304*TA)
     1         *TA**2+174209.*10.**(-1302.88/TA))
C
C         ***
C         *  PRECIPITABLE WATER (CM) AND ATMOSPHERIC TRANSMISSION
C         *  COEFFICIENT DUE TO DUST AND WATER.
C         ***
         U=10.**(-0.579+0.247*SQRT(EAIR))
         TAU=0.95-0.077*U**0.3
C
C         ***
C         *  PREPARE TO INTEGRATE SOLAR RADIATION OVER TIME INTERVAL.
C         *    RTOP - SOLAR RADIATION AT TOP OF ATMOSPHERE (CAL/CM**2).
C         *    RDRCR - DIRECT, CLEAR SKY SOLAR RADIATION AT GROUND (CAL/CM**2)
C         ***
         RTOP=0.
         RDRCR=0.
         AMULT=0.5
C
C         ***
C         *  INITIAL TIME FOR INTEGRATION.
C         ***
      TIME=FLOAT(ITIME)-DT/2.
C
C            ***
C            *  INTEGRATE AT HALF-HOUR INCREMENTS
C            ***
      NT=2*IDT+1
            DO 20 J=1,NT
C
C
C
C            ***
```

```
C          *  SOLAR HOUR ANGLE: COSINE OF THE SUN'S ZENITH ANGLE:
C          ***
           HRAGL=(TIME+DELT-12.)*PI/12.
           COSZ=SLAT*SDEL+CLAT*CDEL*COS(HRAGL)
C
C          ***
C          *  COSZ LESS THAN ZERO: SUN BELOW HORIZON - NO RADIATION.
C          ***
           IF(COSZ.LE.0.) GO TO10
C
           IF(J.GT.1) AMULT=1.
           IF(J.EQ.NT) AMULT=0.5
           RTOP=RTOP+AMULT*60.*COSZ
C
C          ***
C          *  IF COSZ SMALL, ATMOSPHERIC TRANSMISSIVITY EXPRESSION
C          *  WILL UNDERFLOW.
C          ***
           IF(COSZ.LT.1E-2) GO TO 10
C
           RDRCR=RDRCR+AMULT*60.*TAU**(1./COSZ)*COSZ
   10      TIME=TIME+0.5
   20      CONTINUE
C
C        ***
C        *  RDFCR - DIFFUSE, CLEAR SKY SOLAR RADIATION AT GROUND (CAL/CM**2).
C        *  RSCR  - TOTAL CLEAR SKY SOLAR RADIATION AT GROUND (CAL/CM**2).
C        *  RNSOL - NET INCOMING SOLAR RADIATION AT GROUND (CAL/CM**2).
C        ***
   30    RDFCR=(0.91*RTOP-RDRCR)/2.
         RSCR=RDRCR+RDFCR
         RNSOL=(1.-ALB/100.)*FAC(1)*RSCR
      RSOL=RSCR*FAC(1)
C
C        ***
C        *  TG - GROUND TEMPERATURE.
C        *  RLCR - OUTGOING CLEAR SKY LONGWAVE RADIATION (CAL/CM**2).
C        *  RNLW - NET OUTGOING LONGWAVE RADIATION (CAL/CM**2).
C        *  RNET - NET RADIATION AT GROUND (CAL/CM**2).
C        ***
         TG=TA
         RLCR=(SIG*TA**4*(0.18+0.25*10.**(-1.26*FAIR))-0.007*(TA-TG))
     1   *60.*DT
         RNLW=RLCR-FAC(2)*(SIG*TA**4*60.*DT-RLCR)
         RNET=RNSOL-RNLW
C
C        ***
C        *  EFFECT OF WIND.
C        ***
         FWND=0.35*(0.5+WIND)*1519./880./25./6.*DT
         FWND=FWND*(FSAT-FAIR)
C        ***
```

```
C          *  NET INCREMENT OF ETP
C          ***
           ETP=(DLTA*RNET/58.6+0.64*EWND)/(DLTA+0.64)
      RETURN
C
C     ***
C     *  CODED BY JACK MENEELY, OCTOBER 1973.
C     ***
      END
```

```
      SUBROUTINE POLYGO(NAME,AT,ONG,NSIDE,II,JJ,NMAX)
      INTEGER LIST(7)
      INTEGER*2 IPT(500),JPT(500),GRIDI(34),GRIDJ(34),LINK(500)
      INTEGER*2 II(500),JJ(500)
      DIMENSION AT(34),ONG(34)
      FAC=1.
      IF(NAME.LT.0) FAC=4.
      DO 10 I=1,500
      IPT(I)=0
      JPT(I)=0
10    LINK(I)=0
      DO 20 I=1,NSIDE
      R=249.635*TAN((90.-AT(I))/114.5916)
      A=(-ONG(I)+10.)/57.29578
      GRIDI(I)=(257.+R*COS(A)) *FAC+0.5
20    GRIDJ(I)=(257.+R*SIN(A)) *FAC+0.5
      NBCELL=1
      DO 50 I=2,NSIDE
      J=I-1
      IF(GRIDI(I)-GRIDI(J)) 15,40,15
15    ITEMP=GRIDI(I)-GRIDI(J)
      DIRECT=FLOAT(ITEMP)
      ITEMP=GRIDJ(I)-GRIDJ(J)
      ROWF=1.
      IF(ITEMP.LT.0) ROWF=-1.
      SLOPE=FLOAT(ITEMP)/DIRECT
      SLABS=ABS(SLOPE)
      ISTEP=1
      IF(DIRECT.LT.0.) ISTEP=-1
      DROW=0.
      ICOL=GRIDI(J)
      NSTEP=0
30    ICOL=ICOL+ISTEP
      NSTEP=NSTEP+1
      DROW=SLABS*FLOAT(NSTEP)*ROWF+0.5
      IF(ROWF.LT.0) DROW=DROW-1.
      IPT(NBCELL)=ICOL
      JPT(NBCELL)=GRIDJ(J)+IFIX(DROW)
      NBCELL=NBCELL+1
      IF(ICOL.NE.GRIDI(I)) GO TO 30
      GO TO 50
40    IPT(NBCELL)=GRIDI(I)
      JPT(NBCELL)=GRIDJ(I)
      NBCELL=NBCELL+1
50    CONTINUE
      NBCELL=NBCELL-1
C
C        SORT BOUNDARY POINTS BY COLUMN AS PRIME CHARACTERISTIC
C        AND ROW AS SECONDARY.
C
      IFLINK=1
      LINK(1)=999
      DO 100 I=2,NBCELL
```

```
      IPL=IPT(I)
      NEXT=IFLINK
      LAST=IFLINK
      IPTR=IFLINK
60    LAST=IPTR
      IPTR=NEXT
      ICOL=IPT(IPTR)
      NEXT=LINK(IPTR)
      IF(IPL-ICOL) 65,70,75
C
C        INSERT NODE
C
65    IF(IPTR.EQ.IFLINK) GO TO 67
      LINK(LAST)=I
      LINK(I)=IPTR
      GO TO 100
67    LINK(I)=IFLINK
      IFLINK=I
      GO TO 100
C
C        EQUAL COLUMNS, TEST FOR ROW CRITERIA
C
70    IROW1=JPT(I)
      IROW2=JPT(IPTR)
      IF(IROW1-IROW2) 65,100,75
C
C        PREPARE TO SEARCH NEXT NODE
75    IF(NEXT.NE.999) GO TO 60
      LINK(I)=999
      LINK(IPTR)=I
100   CONTINUE
C
C        FILL IN COLUMN - START WITH MINIMUM ROW
C
      IPSW=0
      NEXT=LINK(IFLINK)
      ICOL=IPT(IFLINK)
      INUM=1
      IROW=JPT(IFLINK)
200   IF(NEXT.EQ.999) GO TO 250
      IPTR=NEXT
      ICOL1=IPT(IPTR)
      NEXT=LINK(IPTR)
      IF(ICOL.NE.ICOL1) GO TO 240
C
C        SAME COLUMN - ENTER 1ST POINT
C
      II(INUM)=ICOL
      JJ(INUM)=IROW
      INUM=INUM+1
C
C        CHECK 1ST POINT FOR VERTEX
C
```

```
      ISW=1
      DO 210 I=2,NSIDE
      IF(ICOL.NE.GRIDI(I).OR.IROW.NE.GRIDJ(I)) GO TO 210
      ISW=2
      K=I-1
      J=I+1
      IF(I.EQ.1) K=NSIDE-1
      IF(I.EQ.NSIDE) J=2
      IS1=(GRIDI(I)-GRIDI(K))*(GRIDI(J)-GRIDI(I))
210   CONTINUE
      IF(ISW-2) 214,212,220
212   IF(IS1) 220,213,214
213   IKV=GRIDI(J)-GRIDI(I)
      IF(IKV) 214,218,218
218   IPSW=1
      GO TO 220
C
C        CHANGE PRINT SWITCH
C
214   IPSW=IPSW+1
      IPSW=IPSW-(IPSW/2)*2
C
C        CHECK FOR PRINT SWITCH "ON"
C
220   IF(IPSW.EQ.0) GO TO 245
      IR1=IROW+1
      IR2=JPT(IPTR)-1
      IF(IR2.LT.IR1) GO TO 245
      DO 230 I=IR1,IR2
      II(INUM)=ICOL
      JJ(INUM)=I
230   INUM=INUM+1
      GO TO 245
C
C     DIFFERENT COLUMNS - ENTER POINT
C
240   II(INUM)=ICOL
      JJ(INUM)=IROW
      INUM=INUM+1
      IPSW=0
245   ICOL=ICOL1
      IROW=JPT(IPTR)
      GO TO 200
C
C     FINISH
C
250   NMAX=INUM
      II(NMAX)=IPT(IPTR)
      JJ(NMAX)=JPT(IPTR)
      RETURN
      END
```

```
      SUBROUTINE CLODFI(NCL,NCT,IDC,CLAM)
      DIMENSION IDC(3),CLAM(9,3),CDAMT(2)
      REAL CLFR(16,2,3)
     */13*0. , 3*1. ,
     *                         4*0. , 1. , 2*.5 , .34 , 4*0. , 1. , 3*0. ,
     * 11*0. , 1. , 2*0. , -1.,-.5 ,
     *        2*0. , 1.,.5 , 2*0. , .5,.33 , 2*0. , 1. , 3*0. , 1.,.5,
     * 11*0. , -1.,0.,-1.,0.,-.5 ,
     *                  0.,1.,0.,.5,0.,.5,0.,.33,0.,1.,0.,1.,0.,1.,0.,.5/
C
C  INPUTS:  NCL           CLOUD AMOUNT IN LOWEST LEVEL (LEVEL 1 OR 2 ONLY)
C           NCT           TOTAL CLOUD AMOUNT (EIGHTHS)
C           IDC(3)        CLOUD TYPE CODE IN EACH OF 3 LEVELS
C  OUTPUT:  CLAM(9,3)     FRACTION OF SKY COVER FOR EACH OF 9 CLOUD TYPES
C                         IN 3 LEVELS
C
C  INITIALIZE CLAM TO ZEROS
        DO 10 I=1,9
        DO 10 J=1,3
        CLAM(I,J)=0.
   10 CONTINUE
C
C  IF CLOUD AMOUNT IS -1, OBSERVATION CANNOT BE USED
C  IF CLOUD AMOUNT IS 9, SKY OBSCURED, STRATUS OVERCAST ASSUMED
C  IF TOTAL CLOUD AMOUNT IS 0, SKY IS CLEAR
        ICT=NCT+2
        ICL=NCL+2
        GO TO (120,100,20,20,20,20,20,20,20,20,110),ICT
   20 GO TO (120, 30,30,30,30,30,30,30,30,30,110),ICL
C
C  IF CLOUD TYPE IN LEVEL 1 IS -1, OBSERVATION CANNOT BE USED
   30 IF(IDC(1)) 120,40,40
C
C  A CODE IS DEFINED TO INDICATE WHICH LEVELS CONTAIN CLOUDS AND
C  WHETHER A LOWEST LEVEL AMOUNT IS REPORTED.
   40 KODE=1
        IF(NCL.GT.0) KODE=9
        DO 60 I=1,3
        IF(IDC(I)) 60,60,50
   50 KODE=KODE+2**(3-I)
   60 CONTINUE
C
C  KODE IS USED AS AN INDEX FOR ENTERING THE CLFR ARRAY AND DETERMINING
C  WHAT FRACTIONS OF THE SKY COVER ARE TO BE ASSIGNED TO EACH LEVEL
        CDAMT(1)=FLOAT(NCL)/8.
        CDAMT(2)=FLOAT(NCT)/8.
        CDAMT(1)=AMIN1(CDAMT(1),CDAMT(2))
        DO 90 I=1,3
```

```
C
C  COMPUTE FOR ONLY LAYERS WITH REPORTED CLOUDS
      IF(IDC(I)) 90,90,70
   70 DO 80 J=1,2
      CLAM(IDC(I),I)=CLAM(IDC(I),I)+CLFR(KODE,J,I)*CDAMT(J)
   80 CONTINUE
   90 CONTINUE
  100 RETURN
C
C  STRATUS OVERCAST
  110 CLAM(6,1)=1.
      RETURN
C
C  FLAG FOR UNUSABLE OBSERVATION
  120 CLAM(1,1)=-1.
      RETURN
      END
```

```
      SUBROUTINE IRCLOD(B,CL)
      DIMENSION CL(9,3),B(2)
      DO 1 I=1,9
      DO 1 J=1,3
1     CL(I,J)=0.0
      CL(9,1)=B(1)*.333/8.
      CL(2,2)=B(1)*.333/8.
      CL(2,1)=B(1)*.333/8.
      CL(6,1)=B(2)*.333/8.
      CL(1,1)=B(2)*.666/8.
      RETURN
      END
```

```
      SUBROUTINE VICLOD(CV,CL)
      DIMENSION CV(7),CL(9,3)
      DO 1 I=1,9
      DO 1 J=1,3
1     CL(I,J)=0.0
      CL(9,1)=CV(1)/8.
      CL(2,2)=CV(2)/8.
      CL(2,1)=CV(3)/8.
      CL(6,1)=CV(4)/8.+CV(5)/8.
      CL(1,1)=CV(6)/8.
      CL(1,3)=CV(7)/8.
      RETURN
      END
```

```
SUBROUTINE LATLON (I,J,CLAT,CLON)
F1=257.-I
F2=257.-J
F3=I-257.
Y=ATAN(F1/F2)
CLON=1.3962632-Y
CLON=-CLON*57.2957795
CLAT=1.571-2*ATAN(F3/(249.635*SIN (Y)))
CLAT=CLAT*57.2957795
RETURN
END
```

```
      SUBROUTINE ALBEDO(BMT,ALB)
C     *  THIS SUBROUTINE DETERMINES THE EFFECTIVE ALBEDO (PERCENT)
C     *  OF THE CROP-SOIL SYSTEM AS A FUNCTION OF BMT
      IF(BMT) 10,10,20
10    ALB=10.
      RETURN
20    IBMT=BMT+1.
      GO TO (30,30,30,40,50,50),IBMT
30    ALB=10.+4.6667*BMT
      RETURN
40     ALB=24.
      RETURN
50    ALB=24.-(14.*(BMT-4.))
      RETURN
C     *  CODED BY JACK MENEELY, OCTOBER 1973
      END
```

```
      SUBROUTINE PACKER(ARRAY,A,B,C,D,E,F,G,H,I)
      INTEGER*2 ARRAY(10)
      INTEGER A,B,C,D,E,F,G,H,I
      ARRAY(1)=A
      ARRAY(2)=B
      ARRAY(3)=C
      ARRAY(4)=D
      ARRAY(5)=E
      ARRAY(6)=F
      ARRAY(7)=G
      ARRAY(8)=H
      ARRAY(9)=I
  999 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE ERANAL(IDAY,ITIME,KI,IDEL2,NSTA)
      IF (IDAY.LT.1.OR.IDAY.GT.366) GO TO 900
      IF(ITIME.LT.0.OR.ITIME.GT.24) GO TO 900
      IF (KI.NE.1) GO TO 900
      IF(IDEL2.NE.6) GO TO 900
      IF(NSTA.NE.34) GO TO 900
      RETURN
  900 CONTINUE
      WRITE(6,100)
      WRITE(6,102)
      WRITE(6,101) IDAY,ITIME,KI,IDEL2,NSTA
      STOP
  100 FORMAT('1','*******FATAL PARAMETER ERROR   **********')
  101 FORMAT(1X,5I10)
  102 FORMAT(1X,'     DAY       TIME        KI       IDEL2     NSTA')
      END
```

```
      SUBROUTINE STADAT(  TT,TD,W,P,NH,N,ITY,ISG,TMX,TMN)
      DIMENSION ITY(3)
      READ(5,1000) NST,M,IDY,IHR,N,IW,IT,NH,ITY,ID,K7,JPR,IPR,K9,ISG,
     *  K2,IP24,K4,IMX,IMN
 1000 FORMAT(I3,3I2,2I3,2X,I2,I3,3I2,2X,I2,3X,I1,I2,I1,2X,I1,I4,2X,
     *  I1,I4,2X,I1,2I2)
      IF(NST.EQ.747) WRITE(6,2000)
 2000 FORMAT('0 STA  MODYHR  TOT  WND  TEM  LOW  CL CM CH  DEW  SEVEN
     *LUS        NINE          TWO              FOUR'/15X,'CLD',12X,'CLD',1,
     *  'PT   GROUP  INCH      GROUP          GROUP          GROUP')
      WRITE(6,3000)NST,M,IDY,IHR,N,IW,IT,NH,ITY,ID,K7,JPR,IPR,K9,ISG,
     *  K2,IP24,K4,IMX,IMN
 3000 FORMAT(' 72',I3,1X,3I2,I4,I6,I5,I4,2X,3I3,I5,I4,I2,I5,I9,I4,I9,
     *  I4,I9,2I2)
      IF(M) 10,10,20
   10 TT=-999.
      TD=-999.
      W=-999.
      P=-99.
      TMX=-999.
      TMN=-999.
      N=-1
      NH=-1
      ITY(1)=-1
      ITY(2)=-1
      ITY(3)=-1
      ISG=-1
      RETURN
   20 DO 70 I=1,2
      IF(I.EQ.1) JJ=IT
      IF(I.EQ.2) JJ=ID
      IF(JJ) 30,40,40
   30 XX=-999.
      GO TO 60
   40 IF(JJ.GT.50) JJ=50-JJ
      XX=JJ
   60 IF(I.EQ.1) TT=XX
   70 CONTINUE
      TD=XX
      IF(IW) 80,90,90
   80 W=-999.
      GO TO 100
   90 W=IW
  100 IF(K7.EQ.7) GO TO 110
      P=0.
      GO TO 140
  110 IF(JPR) 115,120,120
  115 P=-99.
  120 P=FLOAT(JPR+100*IPR)/100.
      IF(K2.NE.2) GO TO 130
```

```
      P24=FLOAT(IP24)/100.
      IF(P24.LT.0.) P24=99.99
      IF(P.GT.P24) P=-99.
      IF(P24.GT.50.) P24=-999.
  130 IF(P.NE.-99.) P=P*25.4
  140 IF(K9.NE.9) ISG=-1
      IF(IHR.NE.6) GO TO 150
      TMX=-999.
      TMN=-999.
      RETURN
  150 IF(IHR.NE.12) GO TO 170
      TMX=-888.
      TMN=-888.
      IF(K4.NE.4) RETURN
  160 IF(IMN.GE.0) TMN=IMN
      RETURN
  170 TMX=-888.
      TMN=-888.
      IF(K4.NE.4) RETURN
      IF(IMX.LT.0) GO TO 160
      IF(IMX.LT.30) IMX=100+IMX
      TMX=IMX
      GO TO 160
      END
```

```
      SUBROUTINE STAIJN(I,J,N)
C     ASSIGNS STATION NUMBER N TO A SET OF I,J.
      N=35
      IF(I .EQ. 235 .AND. J .EQ. 349) N=1
      IF(I .EQ. 225 .AND. J .EQ. 354) N=2
      IF(I .EQ. 232 .AND. J .EQ. 356) N=3
      IF(I .EQ. 216 .AND. J .EQ. 354) N=4
      IF(I .EQ. 224 .AND. J .EQ. 357) N=5
      IF(I .EQ. 233 .AND. J .EQ. 358) N=6
      IF(I .EQ. 223 .AND. J .EQ. 360) N=7
      IF(I .EQ. 226 .AND. J .EQ. 363) N=8
      IF(I .EQ. 226 .AND. J .EQ. 360) N=9
      IF(I .EQ. 229 .AND. J .EQ. 361) N=10
      IF(I .EQ. 217 .AND. J .EQ. 363) N=11
      IF(I .EQ. 206 .AND. J .EQ. 340) N=12
      IF(I .EQ. 210 .AND. J .EQ. 339) N=13
      IF(I .EQ. 214 .AND. J .EQ. 342) N=14
      IF(I .EQ. 219 .AND. J .EQ. 344) N=15
      IF(I .EQ. 222 .AND. J .EQ. 350) N=16
      IF(I .EQ. 226 .AND. J .EQ. 347) N=17
      IF(I .EQ. 229 .AND. J .EQ. 351) N=18
      IF(I .EQ. 232 .AND. J .EQ. 351) N=19
      IF(I .EQ. 209 .AND. J .EQ. 346) N=20
      IF(I .EQ. 210 .AND. J .EQ. 350) N=21
      IF(I .EQ. 228 .AND. J .EQ. 344) N=22
      IF(I .EQ. 230 .AND. J .EQ. 344) N=23
      IF(I .EQ. 221 .AND. J .EQ. 343) N=24
      IF(I .EQ. 220 .AND. J .EQ. 339) N=25
      IF(I .EQ. 215 .AND. J .EQ. 337) N=26
      IF(I .EQ. 211 .AND. J .EQ. 335) N=27
      IF(I .EQ. 207 .AND. J .EQ. 334) N=28
      IF(I.EQ. 209.AND.J.EQ.360) N=29
      IF(I.EQ.213.AND.J.EQ.367)N=30
      IF(I.EQ.221.AND.J.EQ.369) N=31
      IF(I.EQ.225.AND.J.EQ.372) N=32
      IF(I.EQ.227.AND.J.EQ.371) N=33
      IF(I.EQ.208.AND.J.EQ.363) N=34
      RETURN
      END
      END
```

```
      SUBROUTINE JULIAN(IDAY,IMO,IYR,JDAY)
C
C     *     SUBROUTINE JULIAN CHANGES DATE  GIVEN IN DAY MONTH YEAR IN
C     * JULIAN DAY
C
      DIMENSION NDAYS(12)
      DATA NDAYS/0,31,59,90,120,151,181,212,243,273,304,334/
      IF(IMO.LT.1.OR.IMO.GT.12) IMO=1
      JDAY=NDAYS(IMO)+IDAY
      IF(IYR-IYR/4*4.NE.0) GO TO 10
      IF(IMO.LE.2) GO TO 10
      JDAY=JDAY+1
   10 RETURN
      END
```

```
      SUBROUTINE DAYLT(XLAT,IDAY,DHR)
C     CALCULATE EPHEMERIS OF SUN
      R=0.0174532925
      DAY=IDAY
      EPH=23.5*SIN(.9863*(DAY-80.)*R)
C     CALCULATE HOUR ANGLE
      COH=-TAN(XLAT*R)*TAN(EPH*R)
      DHR=ARCOS(COH)*7.6408787
      RETURN
      END
```

```
      SUBROUTINE BMTDAY(DAYLNT,BMTPRE,BMTNEW,JULDAT,PLNDA2,TMAXF,TMIN
     *)
      INTEGER*2 PLNDA2
      INTEGER PLNDAT
C
C     INITIALIZE
C     CLEAR THE V1 PART OF THE EQUATION.
C     SET THE RESULTING BMTNEW TO -1 IF THE DATE IS BEFORE
C     THE PLANTING DATE AND EXIT.
C     SET THE RESULTING BMTNEW TO 0 IFTHE DATE IS THE
C     PLANTING DATE AND EXIT.
C
      BMTNEW=-1.0
      PLNDAT=PLNDA2
      V1=0.0
      IF(JULDAT-PLNDAT) 10,20,30
   10 CONTINUE
      BMTNEW=-1.0
      GOTO 900
   20 CONTINUE
      ICRPDT=1
   25 BMTNEW=0.0
      GOTO 900
   30 CONTINUE
C
C     SELECT THE PROPER COEFFICIENTS BASED ON THE PREVIOUS BMT.
C     SET V1 TO 1 FOR THE 'A' COEFFICIENTS ON THE FIRST SET.
C     IF BMT IS > OR = TO 5.0 THEN SET IT TO 5 AND EXIT.
C
      IF(BMTPRE.LT.0.0) RETURN
      IF(BMTPRE.LT.1.0) GOTO 40
      IF(BMTPRE.LT.2.0) GOTO 50
      IF(BMTPRE.LT.3.0) GOTO 60
      IF(BMTPRE.LT.4.0) GOTO 70
      IF(BMTPRE.LT.5.0) GOTO 80
C     IF PREVIOUS BMT IS NEGATIVE DO NOT PROCESS AND EXIT.
      BMTNEW=5.0
      GOTO 900
   40 CONTINUE
      B0=44.37
      B1=0.01086
      B2=-0.000223
      B3=0.009732
      B4=-0.0002267
      V1=1.0
      GOTO 90
   50 CONTINUE
      A0=8.413
      A1=1.005
      A2=0.0
      B0=23.64
```

```
      B1=-0.003512
      B2=0.00005026
      B3=0.0003666
      B4=-0.000004282
      GOTO 90
   60 CONTINUE
      A0=10.93
      A1=0.9256
      A2=-0.06025
      B0=42.65
      B1=0.0002958
      B2=0.0
      B3=0.0003943
      B4=0.0
      GOTO 90
   70 CONTINUE
      A0=10.93
      A1=1.389
      A2=-0.08191
      B0=42.18
      B1=0.0002458
      B2=0.0
      B3=0.00003109
      B4=0.0
      GOTO 90
   80 CONTINUE
      A0=24.38
      A1=-1.14
      A2=0.0
      B0=37.67
      B1=0.00006733
      B2=0.0
      B3=0.0003442
      B4=0.0
   90 CONTINUE
      IF(TMAXF.LT.B0) TMAXF=B0
      IF(TMINF.LT.B0) TMINF=B0
      D=DAYLNT-A0
      TMX=TMAXF-B0
      TMN=TMINF-B0
      IF(V1.EQ.1.0) GOTO 100
      V1=D*(A1+A2*D)
      IF(V1.LT.0.0) V1=0.0
  100 CONTINUE
      V2=TMX*(B1+B2*TMX)
      IF(V2.LT.0.0) V2=0.0
      V3=TMN*(B3+B4*TMN)
      IF(V3.LT.0.0) V3=0.0
      BDAY=V1*(V2+V3)
      BMTNEW=BDAY+BMTPRE
  900 CONTINUE
      IF(BMTNEW.GE.5.0) BMTNEW=-1.0
      RETURN
      END
```

```
1.3726  0.3706  0.0313  0.0     0.0     1.3726  0.3706  0.0313  0.0     0.0
 1   27     1    28     0     0
```

236 6 1 6 1 0 1 34

DAY GMT CLOUDS K LATITUDES-LONGITUDES(W) OF CLOUD POLYGON VERTICES
236 450000000713 49.0 113.0 49.9 110.1 47.3 111.5
236 450000000014 49.8 110.2 49.9 109.3 45.9 110.4 47.2 111.5
236 450000000716 49.9 109.4 50.6 106.0 48.0 106.0 45.1 107.0 43.8 108.8 45.9 110.3
236 450000000719 50.6 106.1 50.6 105.0 49.9 105.0 49.9 103.9 50.4 103.5 50.5 103.0 46.0 103.0 46.0 106.8 48.0 106.0
236 450000000439 50.0 103.1 52.5 99.8 54.4 96.0 52.0 97.8 50.0 100.0 49.1 99.6 50.7 97.0 50.1 96.1 45.0 103.1
236 450000000716 46.1 106.6 46.1 103.0 43.2 105.3 43.2 106.1 44.1 105.9 45.1 107.0
236 450000000156 43.1 106.2 45.1 105.3 45.2 103.4 44.1 102.8 41.8 107.0 42.4 107.7
236 450000000084 44.0 107.7 44.9 106.9 44.2 106.4 43.2 107.2
236 450000000224 46.1 102.2 48.9 99.0 48.3 93.8 45.3 101.2
236 450000000224 42.0 104.4 43.1 100.9 42.3 100.8 41.2 104.2
236 450000000004 41.0 104.0 41.0 102.0 39.0 102.0 39.0 104.0
235 450000000004 40.0 97.0 40.0 96.0 39.0 96.0 39.0 97.0
0 0000000000 0.0 0.0

STA	MODYHR	TOT CLD	WND	TEM	LOW CLD	CL	CM	CH	DEW PT	SEVEN GROUP	PLUS INCH	NINE GROUP	TWO GROUP	FOUR GROUP
72747	824 6	0	6	17	0	0	0	0	17	0 0	0	0 0	2 0	47756
72659	824 6	0	11	25	0	0	0	0	18	0 0	0	0 0	0 0	49670
72655	0 0 0	0	0	0	0	0	0	0	0	0 0	0	0 0	0 0	0 0 0
72662	824 6	2	4	21	0	0	0	1	1	0 0	0	0 0	2 0	49455
72554	824 6	4	10	24	4	0	5	0	18	0 0	0	0 0	0 0	49766
72658	0 0 0	0	0	0	0	0	0	0	0	0 0	0	0 0	0 0	0 0 0
72652	824 6	2	0	25	2	0	7	0	16	0 0	0	0 0	0 0	49672
72557	824 6	8	11	28	1	9	0	7	20	0 0	0	0 0	0 0	49477
72651	824 6	1	9	26	1	3	0	0	19	0 0	0	0 0	0 0	48973
72650	824 6	2	5	26	2	1	0	0	17	0 0	0	0 0	0 0	49275
72562	824 6	1	5	17	0	0	0	2	14	0 0	0	0 0	2 0	49661
72775	824 6	8	11	11	8	6	-1	-1	-1	711	0	0 0	2 13	47352
72777	824 6	8	14	13	8	3	-1	-1	11	725	0	0 0	2 25	47752
72768	824 6	8	8	17	6	1	7	-1	14	7 1	0	0 0	2 1	48056
72767	824 6	8	9	19	8	0	5	-1	12	7 6	0	0 0	0 0	48461
72764	824 6	3	6	18	3	0	3	0	13	0 0	0	0 0	2 21	48754
72757	0 0 0	0	0	0	0	0	0	0	0	0 0	0	0 0	0 0	0 0 0
72753	824 6	0	11	23	0	0	0	0	19	0 0	0	0 0	2 68	48565
72755	824 6	2	4	19	2	9	0	0	18	0 0	0	0 0	2 95	48158
72677	824 6	8	9	21	3	5	7	-1	4	7 0	0	0 0	0 0	48559
72666	0 0 0	0	0	0	0	0	0	0	0	0 0	0	0 0	0 0	0 0 0
72851	824 6	8	21	21	5	3	7	-1	17	7 0	0	0 0	0 0	48463
72852	824 6	4	3	19	4	0	3	0	15	0 0	0	0 0	0 0	48663
72862	824 6	8	0	17	8	0	7	-1	14	7 1	0	0 0	0 0	48155
72863	824 6	7	4	16	0	0	0	4	9	0 0	0	0 0	0 0	47746
72870	824 6	6	6	14	6	0	3	0	6	0 0	0	0 0	0 0	47248
72872	824 6	8	12	15	6	4	7	-1	6	0 0	0	0 0	0 0	47246
72874	824 6	8	12	11	8	5	-1	-1	8	7 5	0	0 0	0 0	46450
72564	824 6	1	-1	15	1	0	3	0	1	0 0	0	0 0	2 3	48250
72465	824 6	1	10	22	1	0	3	0	12	0 0	0	0 0	0 0	49561
72458	824 6	0	15	28	0	0	0	0	20	0 0	0	0 0	2 0	49876
72456	824 6	0	10	28	0	0	0	0	21	0 0	0	0 0	0 0	49777
72446	824 6	0	13	27	0	0	0	0	22	0 0	0	0 0	0 0	49776
72469	824 6	1	8	18	1	0	3	0	5	0 0	0	0 0	2 0	48654

EARTHSAT

DAILY WEATHER DIAGNOSTIC

HOR COORD = I VERT COORD = J   PAGE 1 DAY236 TIME 6 GMT   MAP 1 00-06 GMT PREC MM*10

	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232
335	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
336	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
337	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
338	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
339	0	0	0	0	63	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
340	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
342	0	0	0	0	0	0	0	0	2	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0
343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2*	0	0	0	0	0	0	0	0	0	0	0
344	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0*	0	0	0	0	0	0	0	0	0
345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0
346	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0
347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
348	0	0	0*	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0
349	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	0	0	0	0	0	0	0*	0	0	0*	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0
351	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0
352	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0*	0	0	0	0
353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0
354	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
356	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
357	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
358	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0*	0	0	0	0
359	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0*	0	0	0	0
***** MANHATTAN																											
361*	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0*	0	0	0	0	0	0*	0
362*	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
***** AKRON																											

EARTHSAT
DAILY WEATHER DIAGNOSTIC

HOR COORD = I VERT COORD = J PAGE 1 DAY236 TIME 24 GMT MAP 5 00-24 GMT PREC MM*10

	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232
335	95*	95	73	0	0	0	0	0	0	0	0	0	0	0	0	0	16	16	16	16	16	16	16	16	16	16	0
336	73	95	95	95	95	95	73	73	22	22	22	22	16	16	16	16	16	16	16	16	16	16	16	16	13	16	0
337	73	95	95	95*	95	95	95	95	95	78	95	95	95	16	16	16	16	16	16	16	16	16	16	16	16	18	2
338	73	95	95	95	95	95*	95	95	95	95	95	95	95	89	89	55	55	55	16	16	16	16	16	16	16	16	2
339	73	95	95	95	257	95	95	95*	95	95	95	95	95	89	42	55	55	55	16	16	16	16	16	16	16	16	0
340	125	95	95	95	95	95	95	95	95	95	95	95	95	29	29	55	55	55	16	16	16	16	16	16	16	0	0
341	73	95	95	95	95	95	95	95	95	95	95	95	35	29	29	55	55	55	64	16	16	16	16	16	16	0	0
342	73	95	95	95	95	95	95	95	105	95	95	95	35	35*	29	55	64	64	64	16	16	16	18	18	16	0	0
343	73	95	95	95	95	95	95	95	95	95	95	95	35	35	29	156*	64	64	64	64	16	18	18	16	16	0	0
344	73	95	22	22	95	95	95	95	95	95	95	95	35	90	29	64	64	64*	64	16	15	18	82	0	129	0	0
345	0	22	22	22	22	22	22	95	95	95	95	95	35	35	29	64	64	64	16	16	16*	0	0	0	0	0	0
346	0	22	22	7	22	22	95	95	95	95	95	95*	35	35	29	64	16	16	0	0	0	0	0	0*	0	0	0
347	0	22	22	22	22	22	22	22	22	22	95	95	35	35	29	16	0	0	0	0	0	0	0	0	0	0	0
348	0	22	22*	22	22	22	22	22	22	22	22*	22	35	13	13	0	0	0	0	0	0	0	0	0*	0	0	0
349	0	22	22	22	22*	22	22	22	22	0	0	0	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0
350	0	11	11	11	2	22	0*	0	0	0*	13	13	13*	13	13	0	0	0	0	0	0	0	0	0	71	71	0
351	0	11	11	11	11	0	0	0	0*	13	13	13	0	0	13*	0	0	0	0	0	0	0	0	0	71	71	0
352	0	11	11	11	11	0	0	0	0	0	13	0	0	0	0	0	0	0*	0	0	0	0	0*	0	71	71	0
353	0	11	11	11	11	0	0	0	13	13	13	0	0	0	0	0	0	0	0	0	0*	0	0	0	71	71	0
354	0	11	11	11	11	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	71	0
355	0	0	0	38	38	27	0	0	0	13	13	0	0	0	0	0	0	0	0	0	0	0	0	71	71	71	71
356	27	27	27	27	27	0	0	0*	0	13	13	0	0	0	0	0	0	0	0	0	0	0	71	71	71	71	12
357	27	27	27	27	27	0	0	0	0	0*	0	13	0	0	0	0	0	0	0	0	0	0	0	71	0	51	51
358	0	0	0	27	27	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0*	0	51	51	51	187
359	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	51	51	187
360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0*	51	51	197	197
***** MANHATTAN																											
361*	0*	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1*	1*	0	0	0	0	61	197*	197
362*	0*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	61	61	197	197
***** AKRON																											

EARTHSAT
DAILY WEATHER DIAGNOSTIC
PAGE 1 DAY236 TIME 24 GMT MAP 6 00-24 GMT NET RAD LY/DAY

HOR COORD = I VERT COORD = J

	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232
335	114*	110	229	463	459	456	453	451	438	417	407	409	419	437	428	426	349	347	347	348	348	351	351	225	246	247	393
336	237	113	114	113	113	76	221	215	369	363	322	317	346	353	355	355	352	350	345	352	350	228	227	258	164	248	381
337	236	114	114	113*	77	112	113	111	107	104	101	102	105	348	347	348	347	354	355	225	224	229	260	250	378	154	176
338	236	115	79	78	78	114*	114	112	110	98	101	103	106	122	83	117	116	120	227	227	256	292	292	292	367	366	176
339	236	80	79	78	113	114	113	113*	112	104	104	105	103	63	84	159	120	127	291	289	285	292	275	370	369	369	386
340	200	71	70	114	114	114	113	113	113	108	107	107	109	171	168	160	150	157	292	290	285	278	275	273	372	393	389
341	191	71	107	116	115	115	114	113	108	108	112	113	157	173	169	152	159	158	126	288	280	278	376	345	345	395	393
342	190	71	107	116	115	115	114	113	110	113	113	112	158	159*	170	160	128	128	126	284	280	249	130	129	347	429	395
343	189	108	109	116	116	115	112	111	110	113	113	112	160	156	162	130*	130	129	121	119	282	131	130	219	220	270	397
344	226	108	228	236	112	112	112	111	112	114	114	113	158	157	170	130	129	128*	121	287	163	162	220	275	273	272	429
345	518	401	234	233	234	233	233	113	112	114	112	112	159	148	170	130	130	123	290	289	390*	261	277	276	275	243	402
346	523	407	235	234	235	234	113	113	113	113	113	113*	160	157	171	131	405	400	462	435	266	284	298	258*	266	265	427
347	525	410	236	236	236	235	409	408	407	407	113	113	159	157	171	407	471	447	445	438	434	257	254	253	251	247	408
348	526	412	236*	237	237	237	411	410	412	409	407*	405	159	245	243	481	453	452	444	440	428	424	422	253*	249	246	409
349	528	414	238	233	236*	238	412	411	412	503	498	507	247	246	224	462	458	450	447	432	429	429	422	421	268	265	431
350	521	460	278	278	269	415	339*	337	334	505*	255	252	232*	201	221	462	472	457	439	435	433	426	424	438	377	377	265
351	450	223	274	270	253	333	339	336	511*	257	233	263	441	435	198*	441	460	443	439	436	430	428	441	378	373	379	435
352	441	381	452	279	242	350	339	337	511	489	238	474	444	442	444	436	442	440*	438	436	430	446	444*	442	379	381	435
353	432	374	411	380	421	480	319	310	424	422	421	471	446	445	444	437	442	440	436	431	447*	446	445	442	382	383	438
354	433	387	386	395	421	480	471	484	494	425	422	473	472	469	444	438	443	439	437	450	448	448	446	444	384	384	435
355	418	416	438	277	277	338	462	498	473	404	411	472	467	465	461	455	454	452	451	274	451	451	447	336	384	384	385
356	313	312	311	300	300	419	431	479*	477	404	411	473	469	465	462	457	455	418	275	276	309	306	387	383	384	386	438
357	293	292	292	291	298	416	430	462	461	474*	475	411	471	466	464	457	420	420	277	266	266	452	447	385	437	393	395
358	401	400	353	248	291	405	416	461	464	425	431	475	482*	466	465	421	421	277	268	266	265	407*	436	395	394	395	227
359	402	400	355	356	355	363	364	406	409	419	431	475	474	458	463	458	276	276	266	267	265	439	445	397	396	397	229
360	400	356	356	356	356	364	362	367	402	421	429	442	440	468	465	463	277	267	268	266	441*	438	446*	399	374	198	198
***** MANHATTAN																											
361*	388*	357	357	358	358	370	368	358	406	440	439	432	440	470	467	316	314	242	242*	230*	440	449	448	371	371	199*	199
362*	433*	403	403	358	358	372	383	421	432	441	446	443	443	470	284	282	277	243	241	272	450	450	427	373	373	200	200
***** AKRON																											

EARTHSAT
DAILY WEATHER DIAGNOSTIC

HOR COORD = I VERT COORD = J   PAGE 1 DAY236 TIME 24 GMT   MAP 7 00-24 GMT ETP MM*10

	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232
335	40*	41	55	82	85	85	81	75	69	61	58	58	56	53	48	48	40	39	39	48	48	54	54	40	43	44	61
336	54	41	43	44	46	42	54	50	59	53	46	45	41	41	42	41	40	40	47	48	48	40	40	44	34	44	66
337	50	38	42	43*	40	42	41	35	30	22	21	20	17	42	40	40	40	41	48	34	35	40	44	43	60	38	40
338	48	35	33	36	36	40*	37	35	26	18	19	18	17	19	14	17	17	19	34	34	39	48	48	49	63	63	40
339	48	32	33	35	37	37	31	27*	26	19	19	16	16	14	15	22	19	19	40	42	47	47	45	63	64	64	66
340	43	30	32	37	34	33	30	27	24	19	17	16	17	23	23	22	21	22	40	42	46	45	51	63	64	67	66
341	48	36	40	42	33	30	28	24	20	19	16	20	24	24	23	21	22	22	22	45	45	51	63	61	61	67	66
342	52	38	43	44	45	40	35	23	18	17	18	19	24	22*	22	20	18	18	22	44	52	48	33	34	60	69	66
343	55	47	48	50	45	42	37	31	20	18	18	19	24	22	20	17*	17	24	28	28	73	33	34	44	43	48	66
344	63	51	66	66	50	44	40	32	29	18	19	20	25	25	23	25	22	24*	29	50	38	38	46	51	47	48	69
345	99	89	74	74	69	64	60	44	32	19	18	20	25	28	31	27	28	25	49	51	67*	52	52	52	49	46	66
346	101	91	78	78	72	67	51	48	35	31	19	19*	32	31	34	31	65	72	81	83	54	56	56	52*	50	50	71
347	102	92	75	75	72	68	83	79	65	64	19	31	34	36	39	69	88	83	81	85	82	55	52	50	48	48	71
348	102	90	73*	72	70	69	84	83	80	64	65*	64	37	49	53	91	91	90	97	94	88	85	87	64*	67	51	72
349	103	90	76	75	74*	75	94	96	98	94	97	98	66	67	56	96	100	102	100	96	94	95	94	93	70	68	86
350	102	102	82	78	75	95	87*	89	88	97*	79	70	68*	65	71	106	108	105	102	99	100	105	101	102	87	82	61
351	103	78	81	80	78	87	89	89	109*	79	78	74	96	111	79*	105	107	105	104	116	103	111	112	103	91	81	79
352	102	94	100	81	76	90	89	90	110	108	79	107	112	113	112	114	117	117*	117	118	112	114	117*	115	92	83	85
353	102	94	99	98	103	110	92	91	102	101	102	115	113	113	114	117	119	120	120	123	124*	124	113	103	90	85	90
354	104	97	99	101	104	111	111	112	111	104	104	115	116	116	114	120	121	121	122	125	125	125	114	110	98	85	83
355	107	105	108	88	88	94	108	113	110	102	102	113	113	124	125	117	120	117	119	97	125	125	112	101	89	78	77
356	93	93	94	92	92	105	106	110*	109	105	103	110	113	113	113	117	114	113	97	96	98	96	106	81	88	79	85
357	91	91	90	94	95	109	111	115	115	114*	111	102	109	112	112	111	107	111	99	93	88	111	100	62	87	81	31
358	105	105	102	88	93	105	106	114	114	107	104	109	110*	111	111	99	100	82	82	81	76	90*	91	76	79	81	58
359	105	108	103	103	99	100	99	106	107	105	105	108	108	110	104	100	69	70	72	70	68	91	83	77	78	80	59
360	109	102	103	104	104	103	99	99	106	109	107	105	103	111	104	101	54	63	58	64	86*	84	82*	75	74	51	53
***** MANHATTAN																											
361*	110*	102	103	103	104	104	103	101	110	113	113	108	104	106	105	76	68	59	59*	56*	85	83	81	68	70	51*	52
362*	119*	107	107	102	103	105	106	114	114	114	112	110	107	103	72	69	64	60	56	60	86	86	79	69	69	49	51
***** AKRON																											

EARTHSAT
DAILY WEATHER DIAGNOSTIC

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HOR COORD = I VERT COORD = J        PAGE 1  DAY236  TIME  24 GMT    MAP  8  00-24 GMT TMAX DEG C*10

     206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232
     ***
335  169*170 174 176 177 177 165 158 150 137 135 135 135 135 136 137 138 139 139 177 180 207 210 213 215 217 218
         ****
336  167 168 175 176 177 177 163 155 145 131 132 133 125 134 135 136 138 139 173 177 181 209 212 215 217 219 261
             *****
337  165 166 176 176*177 167 162 153 142 124 124 125 133 134 135 136 138 140 173 178 183 211 215 218 220 260 261
                     *****
338  162 163 166 171 173 168*162 155 136 124 125 125 133 132 133 136 139 150 174 180 186 214 219 221 260 260 260
                         *****
339  158 159 166 171 177 171 151 144*138 125 125 126 135 132 133 145 149 152 176 183 213 230 232 260 259 259 263
                                 ****
340  154 156 164 169 166 162 150 143 138 126 126 126 140 146 147 150 153 154 179 136 228 23' 259 259 259 259 263
                                     *****
341  159 161 165 169 159 157 146 140 136 133 126 139 154 155 156 157 157 157 182 223 229 259 258 258 257 258 262
                                             *****
342  164 165 167 170 171 161 155 137 131 132 147 153 159 160*163 164 161 159 185 224 261 259 257 256 256 257 261
                                                     *   ******
343  168 169 170 171 165 161 155 148 139 141 148 155 160 163 167 168*163 198 231 239 262 258 254 254 254 255 261
                                                     *           ******
344  170 172 173 174 167 163 158 150 147 147 152 157 162 165 165 180 193 203*236 244 264 260 255 254 250 255 261
                                                 *                   ******
345  177 178 180 181 175 171 166 161 152 151 154 158 162 175 181 186 189 210 243 251 268*264 260 257 256 257 264
                                                 *                           *******
346  179 180 182 181 178 174 170 167 156 158 155 158*184 184 188 193 197 242 251 275 276 272 266 262*260 263 268
     ****                                        *                                           *  ********
347  180 181 182 181 179 177 174 171 163 161 156 179 191 193 198 203 240 248 257 279 287 280 271 266 263 276 297
         ****                                *                                                   *
348  181 182 184*182 182 180 177 174 171 164 180*195 197 201 208 239 244 249 282 289 293 293 293 291*317 302 304
                 *****                       *                                                   *
349  182 184 199 198 198*202 206 211 215 212 229 228 228 230 216 244 248 273 284 287 292 295 314 317 319 325 324
                     *****                   *  *****                                            *
350  183 202 201 199 197 203 209*214 219 218*243 234 234*234 251 269 262 275 286 287 293 317 317 319 321 326 328
                                 *****   *           *****                                       *
351  203 202 204 203 203 207 213 219 225*244 246 240 239 279 277*279 279 285 293 307 321 321 320 321 325 327 332
                                     *                       ********                            *
352  205 205 207 207 209 213 218 225 232 249 251 251 281 282 282 307 309 315*310 315 325 323 327*327 325 327 328
                                     *                                   *******                 *
353  208 208 207 229 231 234 239 245 251 256 257 279 282 284 286 319 322 328 334 346 345*342 330 324 324 325 325
                                 *                                                   *******
354  212 212 234 235 236 239 245 249 256 265 265 283 282 285 289 327 332 337 341 346 347 346 328 326 323 323 320
                             *                                                           *
355  250 248 238 239 241 243 246 251 257 264 281 292 302 322 331 345 347 350 351 352 351 349 328 326 317 319 318
                             *                                                           *
356  254 253 253 243 244 246 248 251*255 283 291 295 305 312 319 344 347 353 360 359 353 350 348 317 316 317 317
                                 ****                                                    *
357  258 258 257 273 273 273 274 286 287 289*299 301 303 313 319 340 344 353 369 361 352 348 333 317 314 314 314
                                         *******                                         *
358  262 261 273 271 271 272 273 288 291 294 307 308 309*314 318 330 331 337 344 342 337 335*333 317 313 313 313
                                                     ******                              *
359  266 276 271 266 267 270 273 290 295 299 314 315 314 340 336 324 319 321 330 331 328 329 321 316 313 313 313
                                                             *****               ****
360  295 290 282 266 270 284 294 302 300 306 311 322 320 341 335 328 312 311 323 319 322*322 320*318 314 313 313
     ***** MANHATTAN                                                 *****           *      ********
361*314*295 290 282 282 290 297 306 329 336 341 349 328 343 337 322 311 312 317*321*324 322 318 315 317 314*312
     *****                                                                       ***
362*361*302 300 296 295 299 304 326 334 341 347 354 350 338 332 326 314 316 320 324 328 324 319 316 318 316 316
     ***** AKRCN
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EARTHSAT
DAILY WEATHER DIAGNOSTIC

HOR COORD = I VERT COORD = J   PAGE 1 DAY236 TIME 24 GMT   MAP 9 00-24 GMT TMIN DEG C*10

	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232
335	91*	92	101	108	116	118	113	108	104	99	99	99	100	100	101	102	103	103	104	125	126	140	141	143	144	144	145
336	90	92	105	109	113	115	111	106	101	95	96	98	96	101	101	102	103	103	123	125	127	140	142	144	145	146	165
337	86	87	107	109*	111	111	109	105	99	90	93	95	100	101	102	102	103	104	123	125	128	142	144	145	146	165	165
338	83	85	90	103	107	110*	108	105	97	94	95	96	100	101	101	103	104	111	123	126	129	143	145	147	165	165	165
339	78	80	93	102	110	112	104	102*	100	96	97	97	102	101	102	108	110	111	124	127	142	151	152	165	165	165	159
340	72	75	90	99	102	102	104	103	102	99	99	98	107	109	109	111	112	113	126	129	150	152	165	164	164	164	159
341	78	80	86	92	98	100	104	104	104	104	100	107	112	113	113	114	114	114	127	148	151	165	164	164	164	164	159
342	83	85	88	91	93	105	105	104	105	105	112	114	116	115*	117	118	116	115	129	148	165	164	164	163	163	164	159
343	86	87	89	91	103	104	104	105	108	110	112	114	116	116	119	120*	117	133	150	154	165	164	163	163	163	163	159
344	88	90	91	92	101	102	103	105	106	112	113	115	116	117	117	121	131	135*	152	156	166	165	163	163	161	163	159
345	92	93	94	94	102	103	104	105	106	113	114	115	116	119	120	121	122	138	156	159	168*	167	165	164	163	164	159
346	94	95	95	97	101	104	105	105	106	112	114	115*	120	120	121	122	122	144	150	163	171	169	167	166*	165	159	158
347	96	96	97	101	103	105	106	106	113	113	115	117	121	121	122	123	139	144	151	166	173	172	169	167	166	166	163
348	97	98	100*	106	107	107	107	107	107	113	117*	122	122	122	123	135	137	141	166	174	177	184	187	188*	193	164	164
349	99	101	114	115	116*	117	119	122	124	132	135	134	133	132	124	133	132	152	164	173	178	183	195	196	194	184	179
350	100	116	116	117	117	119	121*	124	127	134*	138	137	135*	134	144	147	140	154	165	173	181	207	202	202	197	185	180
351	109	110	113	118	119	121	124	127	131*	140	141	140	138	160	158*	157	157	164	172	192	210	212	212	211	202	185	178
352	110	110	120	120	122	124	127	131	136	144	145	143	164	163	163	175	177	183*	193	199	213	214	216*	215	202	194	189
353	110	111	111	128	129	131	135	139	144	149	150	164	165	166	168	184	188	195	203	220	220*	220	213	205	201	197	194
354	111	111	128	129	130	133	136	141	147	154	156	163	166	168	171	190	195	201	211	221	220	219	215	213	199	197	196
355	120	120	128	129	131	133	136	141	147	153	166	179	187	192	198	220	219	219	219	221	219	219	214	211	209	198	198
356	120	120	120	128	130	132	135	139*	143	154	171	174	190	196	201	220	219	217	216	219	221	223	224	215	208	199	196
357	120	120	120	129	130	132	135	146	149	151*	175	177	181	199	204	220	219	217	213	218	223	225	217	217	210	208	208
358	120	120	127	126	127	130	133	144	147	149	177	179	183*	202	207	225	224	223	222	224	227	227*	227	220	212	212	213
359	121	127	125	123	123	127	130	142	146	148	178	180	184	202	207	226	226	226	226	229	233	231	232	222	214	214	214
360	131	129	126	121	122	126	130	133	146	148	150	179	182	199	205	212	227	227	228	235	236*	234	231*	229	226	215	215
361	*144*	130	128	126	127	131	131	135	153	155	157	160	179	195	202	213	231	231	233*	234*	233	232	228	225	228	226*	215
362	*251*	131	130	131	132	135	139	153	155	157	159	173	178	194	202	209	232	232	233	234	233	231	228	226	228	225	225

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                                                         EARTHSAT
                                                  DAILY WEATHER DIAGNOSTIC
HOR COORD = I VERT COORD = J                                  PAGE 1  DAY236  TIME  24 GMT    MAP 10  00-24 GMT BMT*100

    206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232
  ***
335-100*485 499-100-100-100-100-100 494 471 471 477 481-100-100-100-100-100-100-100-100-100-100-100-100-100-100
         ****
336-100-100-100-100-100-100-100 497 484 474 479 470 491-100-100-100-100-100-100-100-100-100-100-100-100-100-100
              *****
337-100-100-100-100*100-100-100 497 472 455 480 478 496 488 490 491 496-100-100-100-100-100-100-100-100-100-100
                     *****
338-100-100-100-100-100-100*100 499 495 465 470 483 497 483 489 491 492-100-100-100-100-100-100-100-100-100-100
                            *****
339-100-100-100-100-100-100-100-100*100 486 486 487 476 432 485-100-100-100-100-100-100-100-100-100-100-100-100
                                    ****
340-100-100-100-100-100-100-100-100-100-100 499 496-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                           *****
341-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                                   *****
342-100-100-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100-100-100-100-100-100-100-100-100-100-100
                                                        *   ******
343-100-100-100-100-100-100-100-100-100-100-100-100-10/-100-100-100*100-100-100-100-100-100-100-100-100-100-100
                                                       *             ******
344-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100-100-100-100-100-100-100
                                                     *                         ******
345-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100-100-100-100-100
                                                    *                                      *******
346-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100-100-100-100-100-100-100-100-100-100*100-100-100
    ****                                          *                                                 *  ********
347-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
          ****                                  *                                                  *
348-100-100-100*100-100-100-100-100-100-100-100*100-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100
                 *****                        *                                                   *
349-100-100-100 498-100*100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                         *****              *  *****                                              *
350 499-100 499-100 490-100-100*100-100-100*100-100-100*100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                 *****        *              *****                               *
351 466 466 494 487 487 495-100-100-100*100-100-100-100-100-100*100-100-100-100-100-100-100-100-100-100-100-100
                                        *                         *********                     *
352 454 454 495 494 495-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100-100-100*100-100-100-100-100
                                       *                                     *******           *
353 443 443 444 456 459 471 482 499-100-100-100-100-100-100-100-100-100-100-100-100-100*100-100-100-100-100-100
                                     *                                                   *******
354 422 431 435 447 457 469 481 499-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                   *                                                         *
355 401 402 433 434 446 458 472-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                 *                                                             *
356 399 399 399 421 424 436 459-100*100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                     ****                                                     *
357 397 397 397 412 422 435 450 488 499-100*100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                             *******                                         *
358 395 394 399 398 400 413 425 475 489 499-100-100-100*100-100-100-100-100-100-100-100-100*100-100-100-100-100
                                                         ******                             *
359 394 397 394 390 391 398 413 464 477 491-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
                                                                   *****                ****
360 401 399 394 383 387 396 411 425 468 481 493-100-100-100-100-100-100-100-100-100-100*100-100*100-100-100-100
   ***** MANHATTAN                                                       *****         *           ********
361*415*400 397 393 394 400 411 426 484-100-100-100-100-100-100-100-100-100-100*100*100-100-100-100-100-100*100
    *****                                                                          ***
362*100*461 460 401 401 413 425 472 486-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100-100
    ***** AKRON
```

```
                                          EARTHSAT
                                   DAILY WEATHER DIAGNOSTIC
                                      PAGE 1  DAY236  TIME  24 GMT    MAP 11  00-24 GMT SOLAR RAD LY/DAY
HOR COORD = I VERT COORD = J
    206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232
 ***
335 114*114 291 631 628 625 622 618 614 610 636 633 645 642 592 589 488 487 487 485 485 531 530 379 366 367 603
        ****
336 296 116 115 114 114 113 279 276 457 457 484 485 520 520 487 486 491 490 488 489 488 331 381 382 252 370 564
             *****
337 295 115 115 114*114 114 114 113 113 113 141 142 142 491 490 490 494 493 493 338 337 383 384 371 525 214 297
                   *****
338 296 116 116 114 115 115*114 113 113 141 142 143 143 147 146 204 203 203 341 339 339 424 425 425 487 487 298
                         *****
339 295 116 115 115 115 115 114 114*114 143 143 144 145 147 147 205 204 205 381 380 377 427 376 491 491 490 571
                               ****
340 294 139 139 116 115 115 114 115 114 143 144 144 145 210 216 205 205 207 383 382 379 379 378 494 494 577 573
                                     *****
341 317 141 141 117 116 116 115 115 144 144 114 113 176 212 217 207 208 208 162 382 383 381 498 497 495 530 577
                                                *****
342 317 142 142 117 116 115 116 114 121 114 114 113 177 177*217 210 164 163 163 385 384 383 220 220 499 583 579
                                                     *   ******
343 318 142 143 117 117 117 122 122 122 114 114 113 177 183 219 165*165 164 164 164 385 223 221 304 304 386 582
                                                    *              ******
344 318 143 303 276 123 122 122 122 122 115 114 114 188 187 221 165 165 164*165 390 224 223 306 392 390 389 584
                                                   *                      ******
345 685 510 284 283 283 282 283 123 123 115 123 124 188 185 222 167 166 167 393 392 535*399 397 395 391 390 587
                                                  *                                    *******
346 668 493 285 285 285 285 124 123 123 125 124 125*189 189 223 158 523 520 617 636 429 427 452 451*450 448 649
                                                 *                                           *  ********
347 669 495 287 286 286 286 495 495 494 493 125 125 187 190 225 526 626 622 643 638 636 428 430 428 425 424 624
 ****                                                                                           *
348 670 498 287*287 287 287 496 497 498 497 495*495 191 331 330 629 628 648 646 643 641 637 636 431*428 424 625
     ****                                          *                                                *
349 672 501 288 288 288*288 500 499 501 649 645 686 335 334 330 633 656 653 649 646 644 642 637 637 457 454 658
          *****                                                                                    *
350 673 587 374 373 371 502 448*446 469 678*369 366 308*305 330 635 683 681 652 650 647 645 641 669 561 560 455
                       *****              *  *****                                                *
351 678 377 374 374 372 451 474 472 685*373 370 383 616 614 305*610 665 657 656 654 650 648 674 564 563 564 563
                                 *****      *          *****                                     *
352 679 592 628 412 412 492 476 474 686 683 370 697 666 665 615 662 665 663*661 659 655 679 678*676 566 566 666
                                         *                     ********                        *
353 718 632 632 630 630 694 476 475 594 592 592 698 669 667 667 664 667 665 664 661 684*684 681 676 569 569 570
                                    *                               *******                  *******
354 720 635 633 633 633 697 694 693 690 594 594 700 698 697 669 667 669 668 665 689 687 686 682 680 571 572 668
                                  *                                                        *
355 722 721 719 492 476 554 697 694 693 598 612 703 700 699 698 693 693 692 692 468 690 689 684 576 573 572 572
                               *                                                             *
356 578 577 577 574 573 717 700 697*695 599 615 704 701 700 695 696 694 643 470 469 518 517 579 572 575 575 672
                                 ****                                                        *
357 581 579 578 577 576 720 720 716 698 700*707 617 703 702 700 697 645 645 473 458 456 691 685 576 676 605 606
                                           *******                                          *
358 729 728 653 507 578 723 722 719 705 636 633 695 706*704 703 644 645 471 457 457 456 627*671 606 607 608 408
                                                    ******                                 *
359 732 731 657 656 657 656 655 652 640 639 634 697 695 693 703 699 471 472 458 457 455 674 683 609 610 611 409
                                                                *****                  ****
360 735 659 660 660 659 658 658 645 642 658 656 652 651 708 704 702 472 459 458 456 675*673 686*611 536 317 318
 ***** MANHATTAN                                                           *****       *         ********
361*718*663 662 661 662 691 666 647 647 661 660 656 665 709 706 526 522 426 425*410*675 669 687 524 523 320*319
 *****                                                                               ***
362*673*664 664 664 664 692 692 689 687 664 673 671 669 710 483 480 478 428 425 472 692 691 616 526 525 320 320
 ***** AKRCN
```

5.2 Agronomic Growth

Agronomic Growth and display of growth parameters requires two programs:

1) AGRUN grows in each i,j day the crop on a daily basis using historic cell characteristics and daily meteorological data;
2) DAYRUN displays in a computer printout the daily cell status for each i,j,k.

The primary output produced by this section is a daily status file which also contains data concerning plant growth from planting to present. This information is updated continuously and provides a basis for yield prediction. This file contains the following information:

1. i,j,k
2. Julian date
3. Soil moisture (three-layer capacity)
4. ET of each layer
5. ETP
6. Average ETP
7. Precipitation
8. Average stress
9. Maximum and minimum temperature
10. Total to-date runoff
11. Stress in BMT interval
12. Number of days BMT interval
13. Number of crop days
14. Soil type
15. Net radiation

5.2.1 AGRUN

5.2.1.1 Functional Description

Agronomic Growth Discussion

The program AGRUN operates on the 12.5 x 12.5 nautical mile matrix and utilizes the Precipitation and ETP diagnoses spread equally into the four cells which surround each of the 25 nautical mile grid mesh points. The key activities performed include:

(a) Calculation of "percolation" and runoff utilizing various approximations and models. The output of this step is a three layer soil moisture profile for the specific soil specified in that cell.

(b) Calculation of actual transpiration as a function of crop phenology. These calculations operate on the soil moisture profile resident in the file from the previous day. The output from this calculation is the moisture budget account balance from the start date.

(c) The results of the ETP and ET calculations are ratioed to provide a "stress" value.

5.2.1.2 Mathematical Description

Moisture Budget

The basic soil moisture budget used in the EarthSat "System" was developed by Baier and Robertson (1966). The so-called "Versatile Budget (VB)" divides the total crop available moisture into several zones.

Water is extracted simultaneously from different depths in the soil profile permeated by the wheat plant roots in relation to the rate of potential evapotranspiration (ETP) and the available soil moisture in each zone. The general equation for the Versatile Budgeting model for calculating daily actual transpiration per zone is:

$$ET_i = \sum_{j=1}^{n} k_j \frac{S'_j(i-1)}{S_j} Z_j \; ETP_i e^{-w(ETP_i - \overline{ETP})} \qquad [23]$$

where

ET_i = actual evapotranspiration for day i ending at the morning observation of day i + 1

$\sum_{j=1}^{n}$ = summation carried out from soil zone 1 to N

k_j = coefficient account for soil and plant characteristics to the jth zone

$S'_j(i-1)$ = available soil moisture in the jth zone at the end of day i-1, that is, at the morning observation of day i

S_j = capacity for available water in the jth zone

Z_j = adjustment factor for different types of soil dryness curves

ETP_i = potential evapotranspiration for day i

w = adjustment function accounting for effects of varying PE rates on the AE:PE ratio

$\overline{ETP}$ = long-term average daily PE for month or season.

lower zones, where water is still available in proportion to the assumed vertical root distribution. This adjustment is introduced between emergence and jointing. The adjustment takes the form:

$$k'_j = k_j + k_j \sum_{m=1}^{m=j-1} k_m \quad 1 - \frac{S'_M(i-1)}{SM} \qquad (22)$$

where

k'_j = adjusted k-coefficient for the jth zone

$S'_j(i-1)$ = available soil water in the jth zone

S_j = capacity for available water in the jth zone

Three relationships between available soil moisture and the ET:ETP ratio are:

Type A. Water is equally available to plants for evapotranspiration over the range from field capacity to permanent wilting.

Type D. Type D assumes no reduction in the ET:ETP ratio over the range of available soil moisture from 100% to 70% (Type D). Beyond these limits the ET:ETP ratio declines rapidly with drying of the soil after an exponential decay form relationship.

Type G. This relationship assumes no reduction in the ET:ETP ratio over the range from 100% to 70% available soil moisture and a linear relationship over the range from 70% to 0%.

The intensity of the evaporating power of the atmosphere must also be considered in analyzing the relationship between soil-moisture status and plant growth. In the VB, the term $e\text{-}w(ETP_i - \overline{ETP})$ accounts for effects of varying daily atmospheric demand rates (ETP_i) on the ET:ETP ratio as a

function of available soil moisture. The equation that estimates the value of w from the soil-moisture stress occurring on the preceding day:

$$w = 7.91 - 0.11 \frac{S'_{(i-1)}}{S_j} 0.100 \qquad (23)$$

To account for water losses through runoff, if applicable, a relationship between soil moisture in the top zone, daily precipitation total, and runoff is included in the VB. On days with $P < 1.00$ inch, the total amount of precipitation is considered to infiltrate into the soil. On days with $P > 1.00$ inch, runoff is estimated from equation (24):

$$\text{Runoff}_i = RRi - I \qquad (24)$$

where: I = amount of water infiltrating into the soil

$$= 0.9177 + 1.811 \log RR_i - 0.0097 \log RR_i \frac{S'_{j(i-1)}}{S_j} 100 \qquad (25)$$

RRi = rainfall in inches for 24 hr. ending the morning of day i + 1

$\frac{S'_{j(i-1)}}{S_j}$ .100 = available soil moisture in percent of capacity (S_j) in the top zone at the end of day i-1.

Equation (25), taken from Linsley, Kohler, and Paulhus (1949), gives the amount of water infiltrating into the soil as a function of 24-hour precipitation total and soil-moisture content in the top zone before the day with precipitation.

It is assumed in the VB model that the water infiltrating into the soil recharges the moisture content in the top zone to its field-capacity value and that the remaining water infiltrates into the next zone and so forth until either all infiltration water is used up or all zones are brought to capacity. Drainage is obtained on days when the precipitation exceeds the total of ETP, runoff, and the sum of moisture deficits over all zones.

Biometeorological Time (BMT)

The moisture budgeting routine includes by necessity an estimation of the phenological events, i.e., a crop calendar. The procedure used by the EarthSat "System" was developed by Robertson (1968).

The biometeorological time scale (BMT) for wheat and other cereals uses day and night temperatures and photo period.

The final model is a triquadratic equation which relates the daily photoperiod and the daily maximum and minimum temperatures to plant maturity from planting (must be specified):

$$m = \sum_{S_1}^{S_2} a_1'(L-a_0) + a_2'(L-a_0)^2 \quad b_1'(T_1-b_0) + b_2'(T_1-b_0)^2$$

$$+ d_1'(T_2-b_0) + d_2'(T_2-b_0)^2 \qquad (26)$$

where

L is daily photoperiod

T_1 is daily maximum temperature

T_2 is daily minimum temperature

and a_0, a_1, a_2, b_0, etc. are characteristic coefficients.

5.2.1.3 AGRUN EXECUTION

<u>Job Control Language</u>

```
//AGRUN   JOB  (BR0001,746),ANDERSON,CLASS=F
//SORTMET EXEC PGM=IEPROC000,PARM='MSG=AP',REGION=60K
//*
//*  METEOROLOGICAL SORT FOR INPUT TO AGRUN
//*
//SYSOUT DD SYSOUT=A
//SYSPRINT DD SYSOUT=A
//SORTLIB DD DSNAME=SYS1.SORTLIB,DISP=SHR
//SORTIN DD DSN=MET,DISP=(OLD,DELETE),
// DCB=(RECFM=F,LRECL=20,BLKSIZE=20)
//SORTOUT DD DSN=&&METS,UNIT=SYSDA,
// SPACE=(CYL,(8,4),RLSE),
// DISP=(NEW,PASS,DELETE),DCB=(RECFM=F,LRECEL=20,BLKSIZE=20)
//SORTWK01 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK02 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK03 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK04 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK05 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SYSIN DD *
 SORT FIELDS=(1,2,A,3,2,A,19,2,A),FORMAT=BI          (See note #1)

//FAGRUN EXEC FORTGCL,PARM.FORT='MAP,ID'
//*
//*        FIRST HALF OF AGRUN
//*
//FORT.SYSIN DD *

                         -  Fortran Source Deck  -

//AGRUN EXEC ASMFCLG,PARM.ASM='LOAD,NODECK',PARM.GO=07      (See note #2)
//*
//*        MODULE AGRUN
//*
//ASM.SYSLIB DD
//              DD DSN=EARTHSAT.MACLIB,DISP=SHR
//ASM.SYSGO  DD DSN=&LOADSET,DISP=(MOD,PASS)
//ASM.SYSIN  DD

                         -  Assembler Source Deck  -

//LKED.SYSLIB DD
//              DD DSN=SYS1.FORTLIB,DISP=SHR
                DD DSN=EARTHSAT.LOADLIB,DISP=SHR

//GO.FT05F001 DD DDNAME=SYSIN
//FT06F001    DD SYSOUT=A
//HISTORIC    DD DSN=HIST.G1,DISP=(OLD,KEEP,KEEP),
// UNIT=2314,VOL=SER=IPIWRK
//ARCHIV  DD DSN=LACIE.START,DISP=(OLD,KEEP,KEEP),
// UNIT=2314,VOL=SER=IPIWRK
//NEWARCH  DD DSN=NEW,DISP=(NEW,CATLG)
```

```
// SPACE=(CYL,(10,4),RLSE),
// UNIT=SYSDA,DCB=(RECFM=F,BLKSIZE=108)
//TEMPARCH DD DSN=ARCH2,DISP=(NEW,CATLG),
// SPACE=(CYL,(10,4)RLSE),
// UNIT=SYSDA,DCB=(RECFM=F,BLKSIZE=108)
//METFILE DD DSN=&&METS,DSIP=(OLD,DELETE)
//SYSUDUMP DD SYSOUT=A

/*
//
```

NOTE 1: Data card for IBM Sort/Merge in this case sorts data by I, J, Julian date. Reference publication is OS Sort/Merge Program release 21.

NOTE 2: This PARM defines the number of days meteorological data for agronomic model to process, normally '07'.

Data Definition Description

GO STEP

FT05F001: dummy file.

FT06F001: Fortran error messages only.

HISTORIC: Historical file which contains region specific agronomic parameters.

ARCHIVE: Previous CYCLE's last day for initialization of this CYCLE. (initially set for first CYCLE as file LACIE. START)

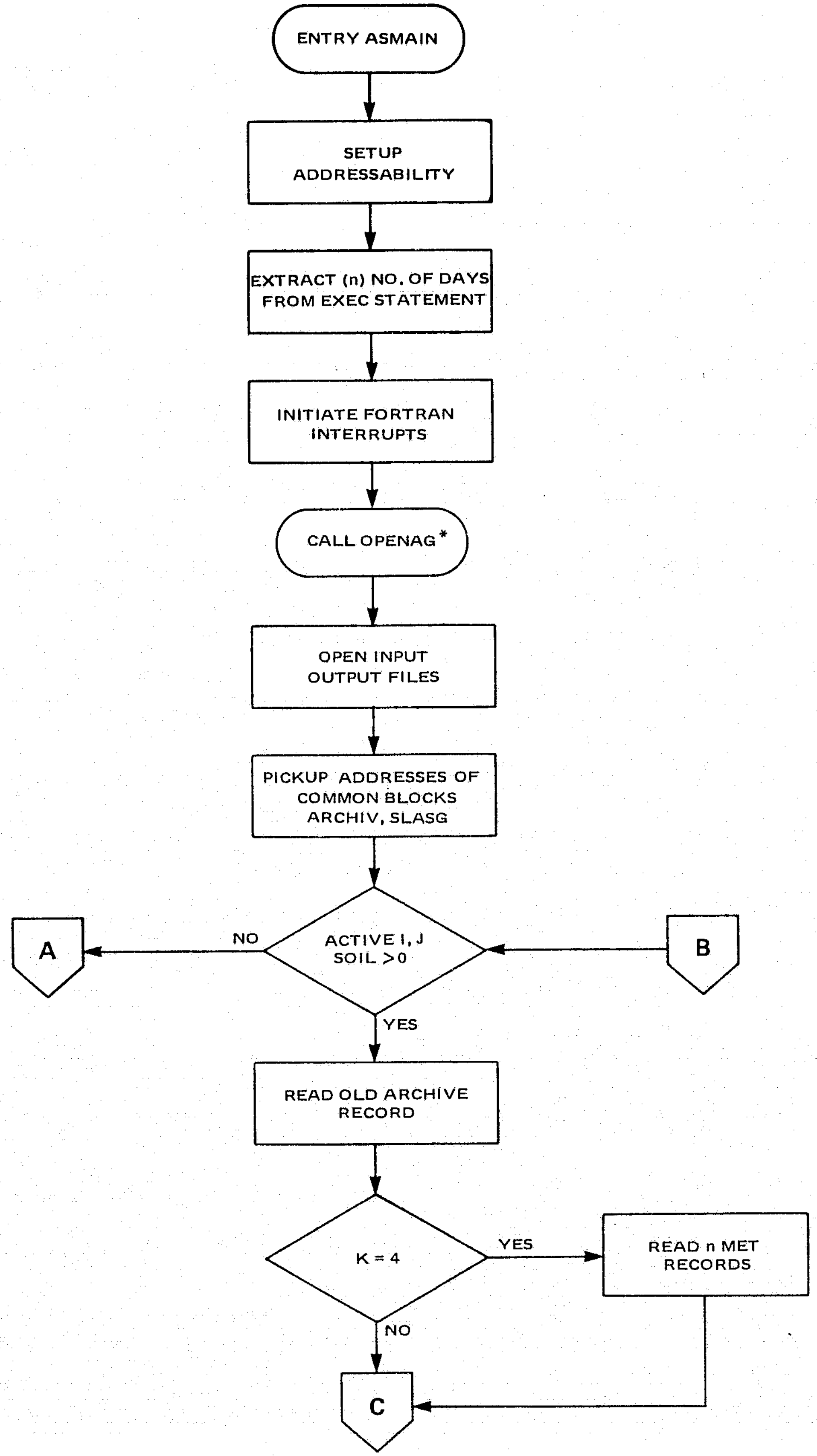
METFILE: Sorted Daily meteorological data for use in AGRUN.

TEMPARCH: This CYCLE's last day file.

NEWARCH: Daily Archive File.

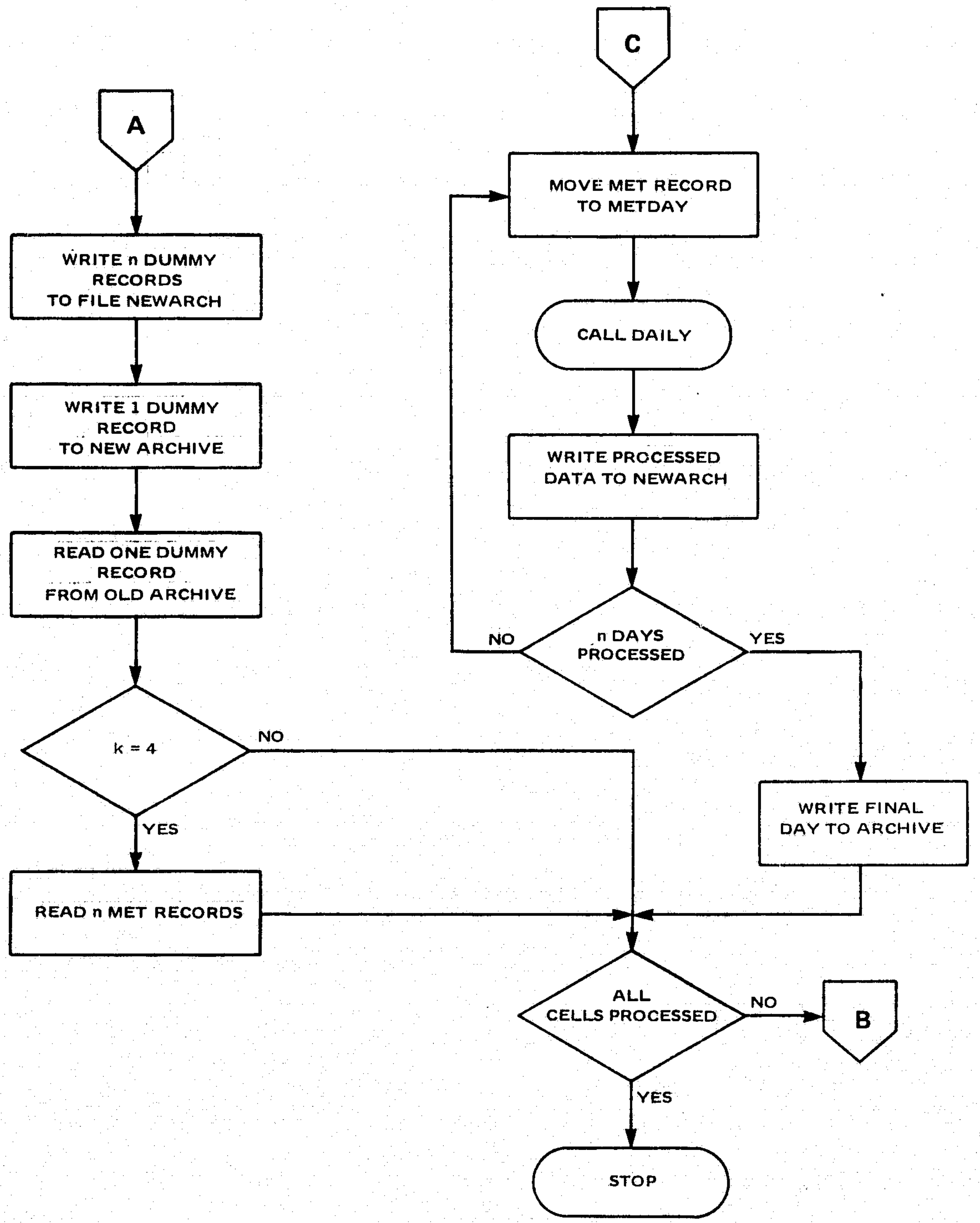
5.2.1.5 FLOWCHART

PROGRAM AGRUN

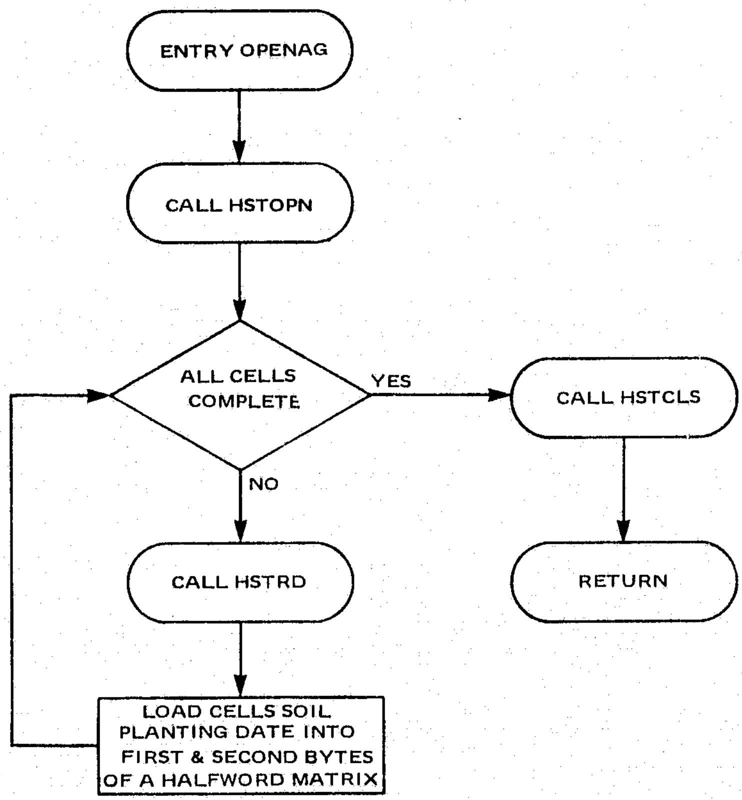


* FORTRAN OPENAG

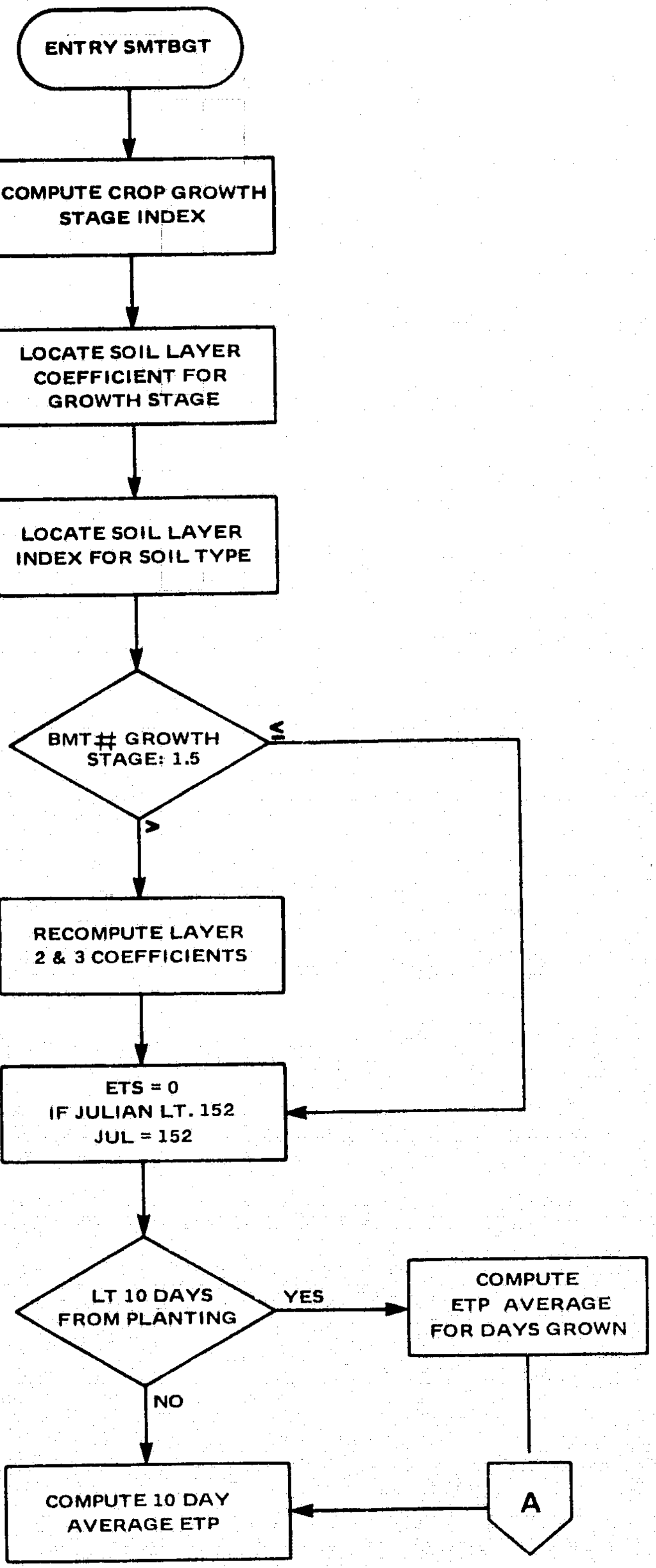
AGRUN


A
WRITE n DUMMY RECORDS TO FILE NEWARCH
WRITE 1 DUMMY RECORD TO NEW ARCHIVE
READ ONE DUMMY RECORD FROM OLD ARCHIVE
k = 4
NO
YES
READ n MET RECORDS
C
MOVE MET RECORD TO METDAY
CALL DAILY
WRITE PROCESSED DATA TO NEWARCH
n DAYS PROCESSED
NO
YES
WRITE FINAL DAY TO ARCHIVE
ALL CELLS PROCESSED
NO
B
YES
STOP

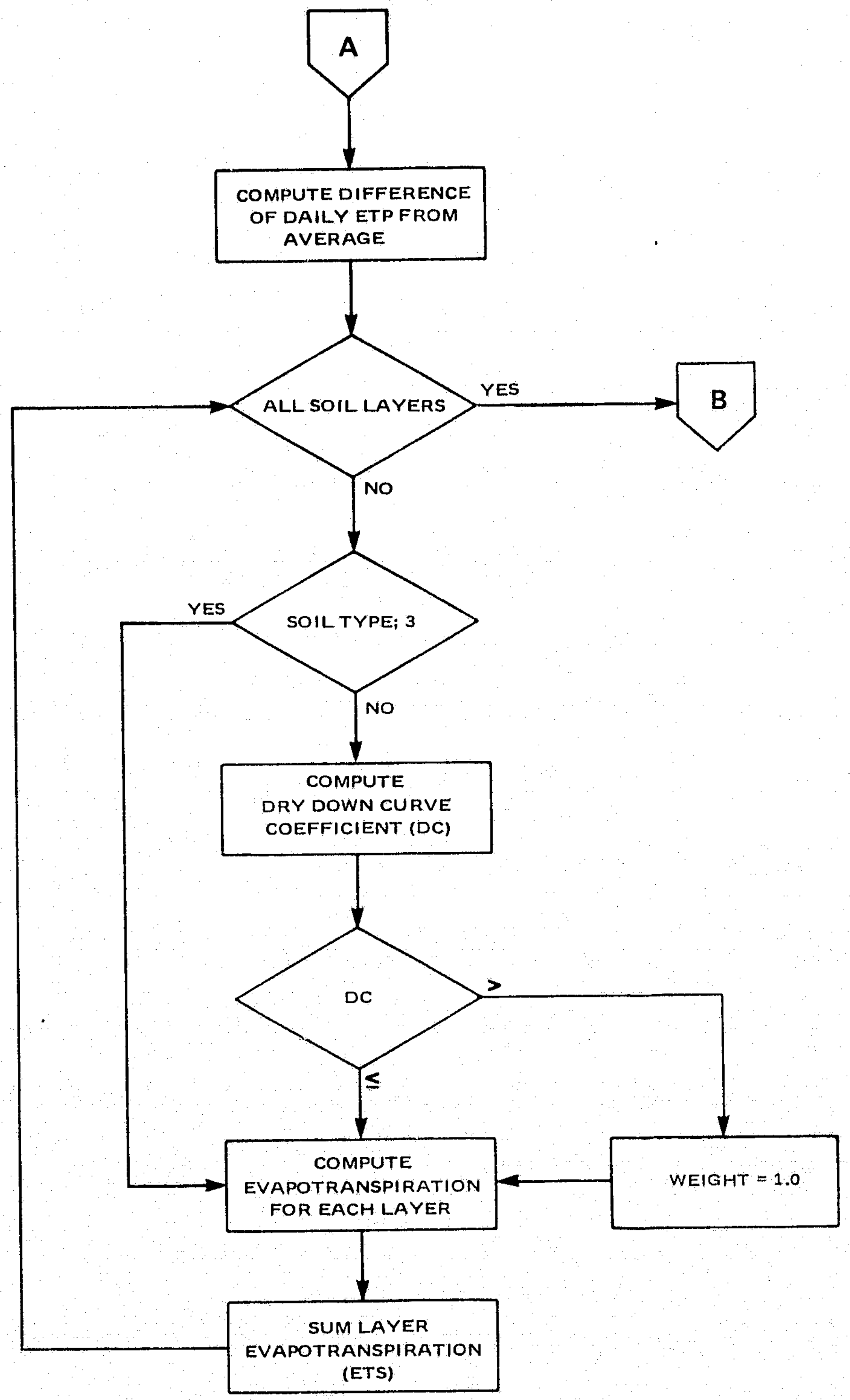
SUBROUTINE OPENAG



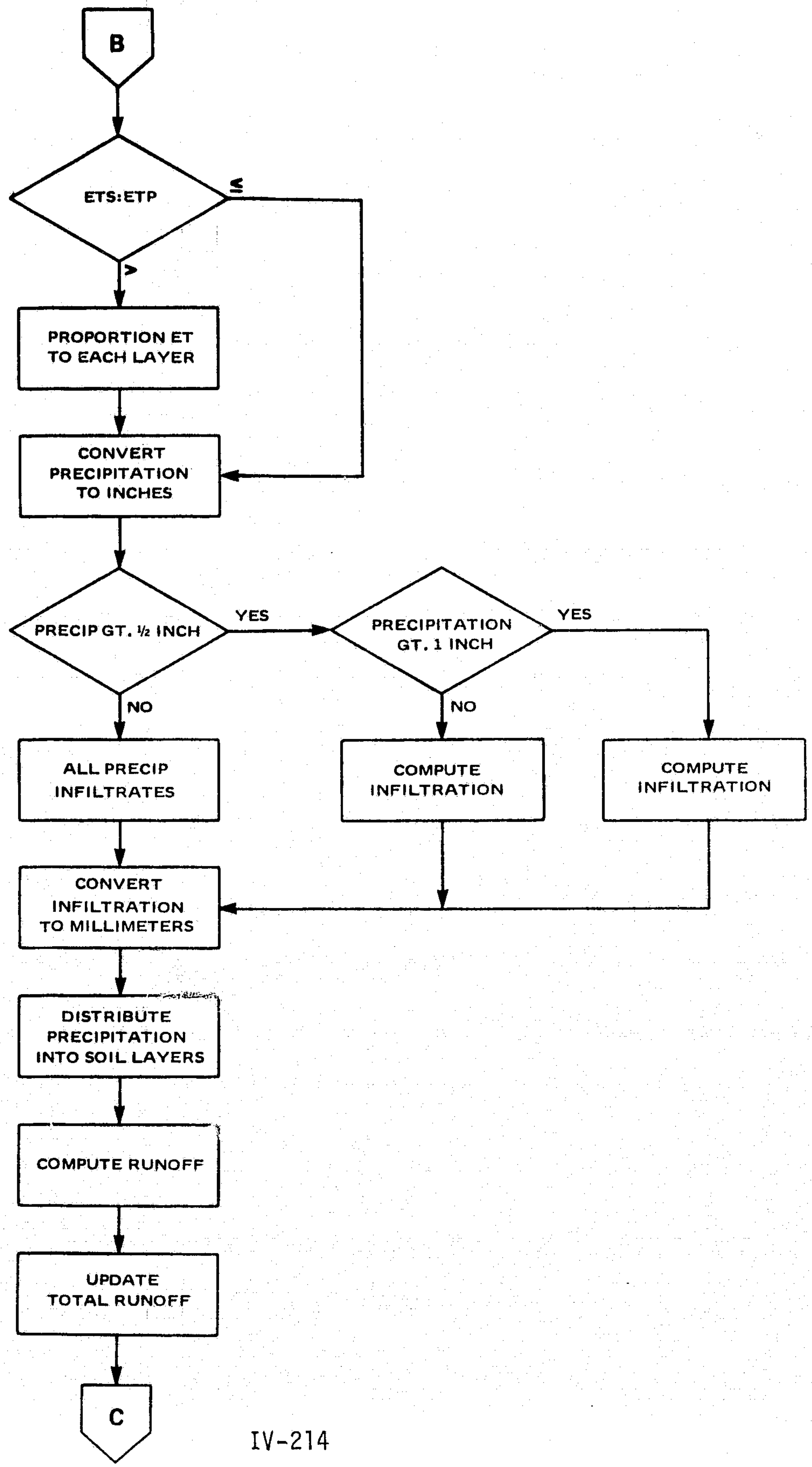
SUBROUTINE SMTBGT



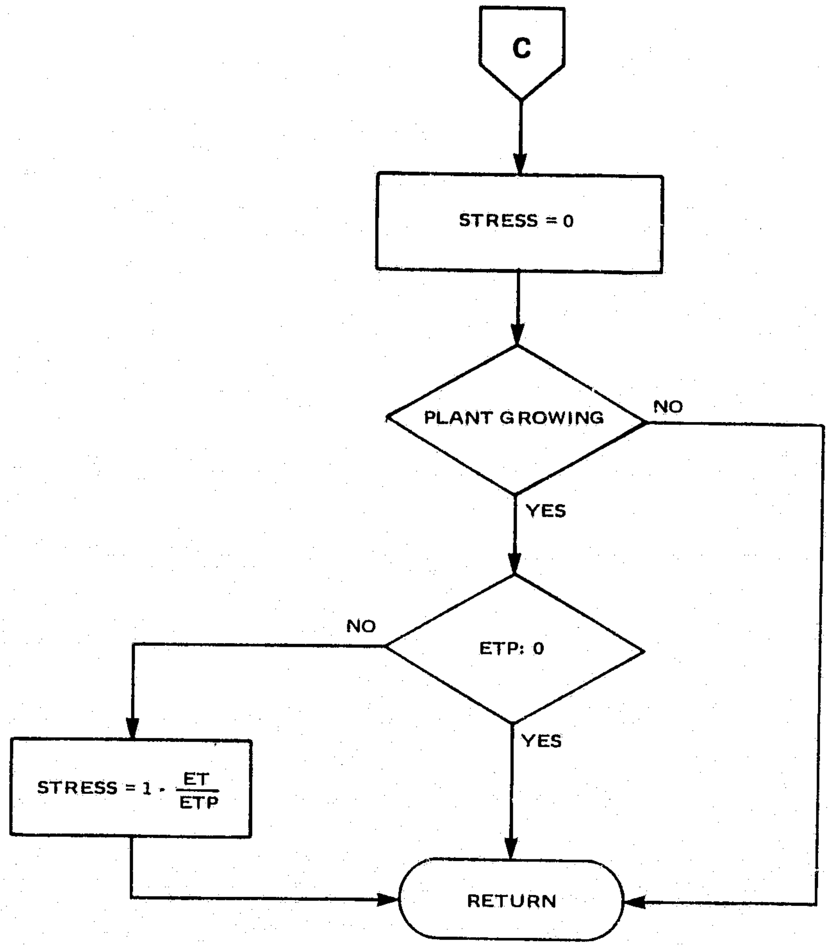
SMTBGT


A
COMPUTE DIFFERENCE OF DAILY ETP FROM AVERAGE
ALL SOIL LAYERS
YES
B
NO
SOIL TYPE; 3
YES
NO
COMPUTE DRY DOWN CURVE COEFFICIENT (DC)
DC
>
≤
WEIGHT = 1.0
COMPUTE EVAPOTRANSPIRATION FOR EACH LAYER
SUM LAYER EVAPOTRANSPIRATION (ETS)

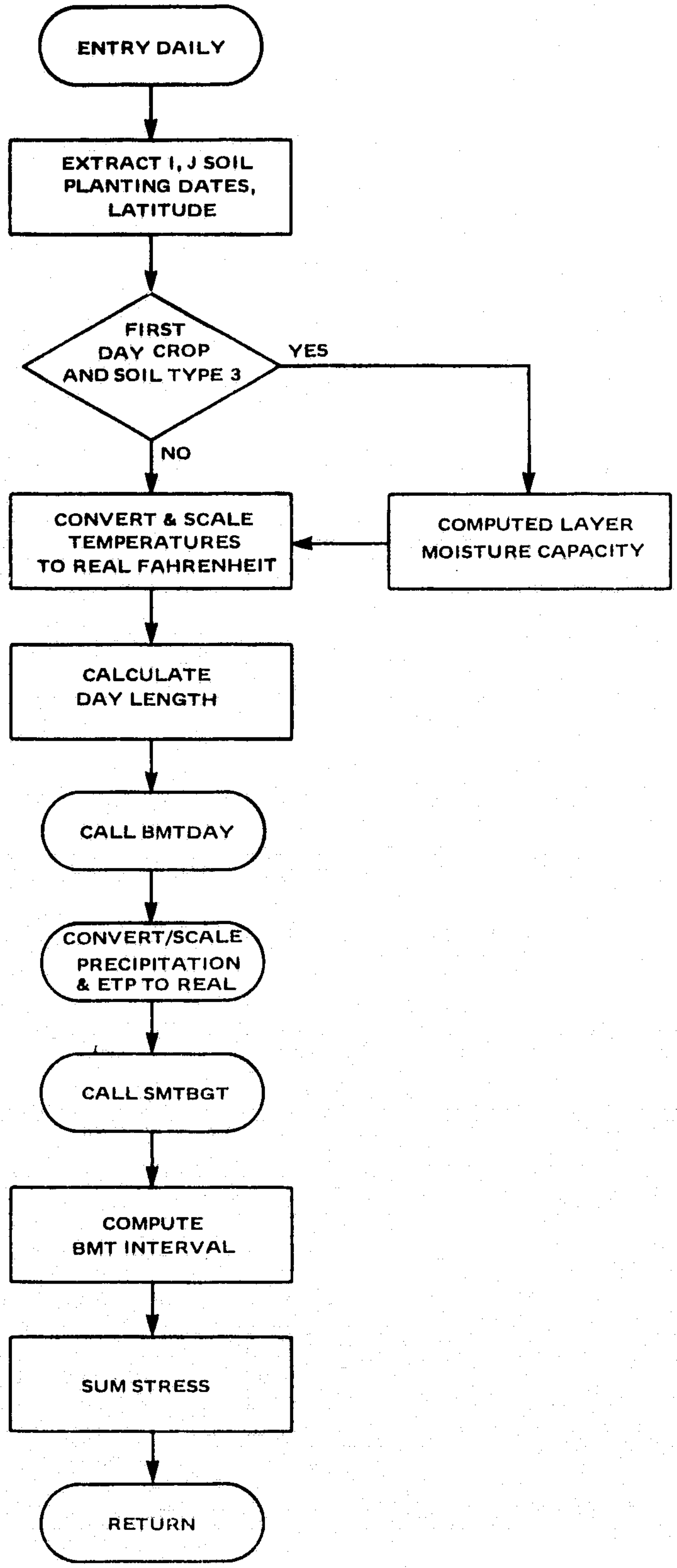
SMTBGT


B
ETS:ETP
≤
>
PROPORTION ET TO EACH LAYER
CONVERT PRECIPITATION TO INCHES
PRECIP GT. ½ INCH
YES
NO
PRECIPITATION GT. 1 INCH
YES
NO
ALL PRECIP INFILTRATES
COMPUTE INFILTRATION
COMPUTE INFILTRATION
CONVERT INFILTRATION TO MILLIMETERS
DISTRIBUTE PRECIPITATION INTO SOIL LAYERS
COMPUTE RUNOFF
UPDATE TOTAL RUNOFF
C

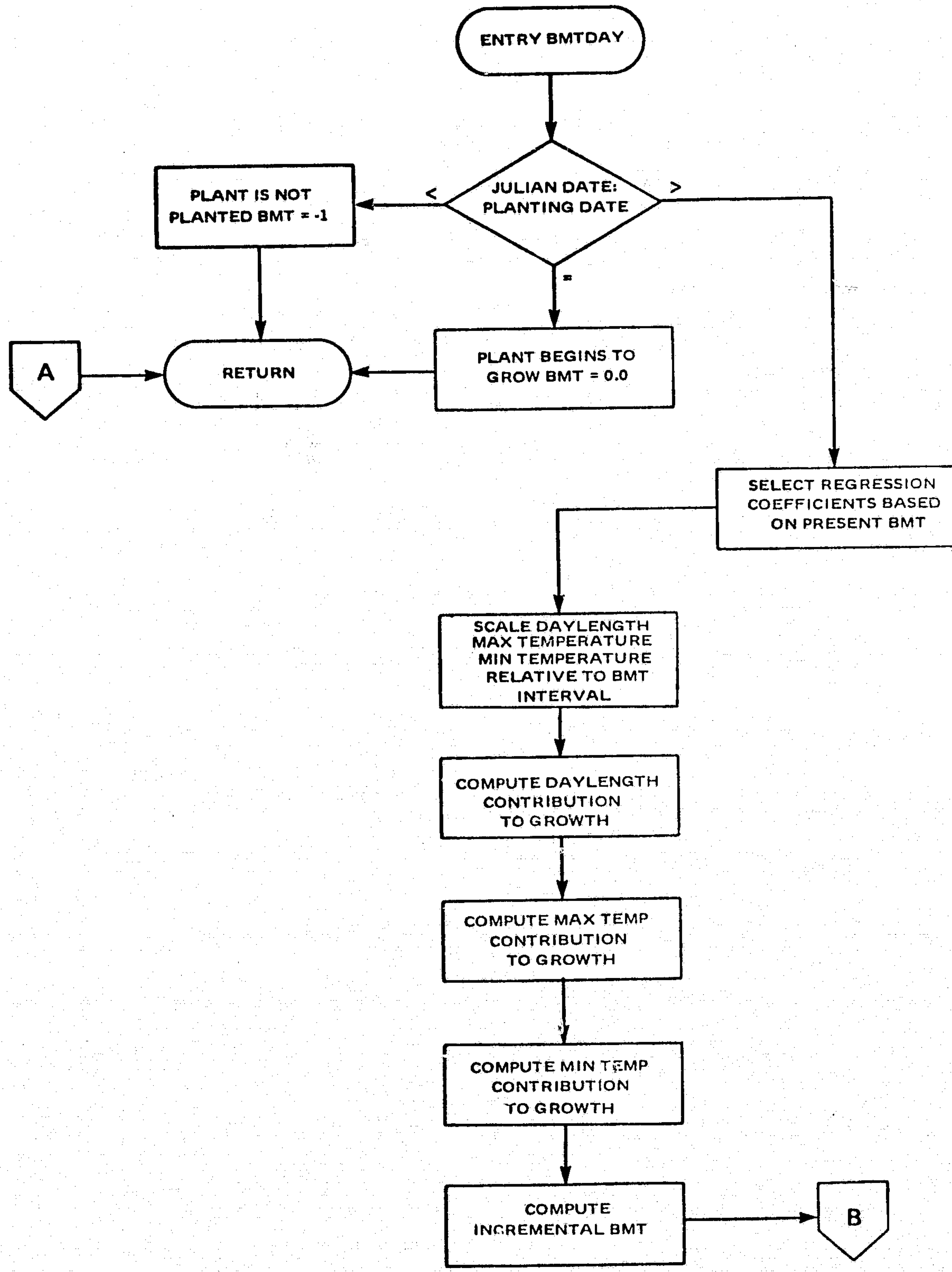
SMTBGT


C
STRESS = 0
PLANT GROWING
NO
YES
ETP: 0
NO
YES
STRESS = 1 - ET/ETP
RETURN

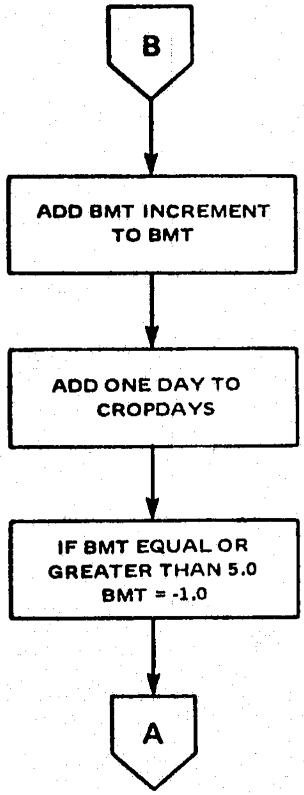
SUBROUTINE DAILY



SUBROUTINE BMTDAY



SUBROUTINE BMTDAY



5.2.1.6 SOURCE CODE

```
         PRINT NOGEN
ASMMAIN  CSECT
         ENTRY BEGIN
BEGIN    SETUP 13
         L     2,0(1)
         PACK  PACKED,2(2,2)
         CVB   3,PACKED
         ST    3,DAYSNOW
         B     INIT
*
DAYSNOW  DC    F'0'
PACKED   DS    D
*
INIT     L     15,IBCOM#AD
         BAL   14,64(15)
*
         L     15,OPENAGAD
         BALR  14,15
*
         OPEN  (ARCHIVE,,NEWARCH,(OUTPUT),TEMPARCH,(OUTPUT))
         OPEN  (METFILE,(INPUT,REREAD))
         LA      5,4
         L     9,DAYSNOW
         LA    8,METREC
READH    BAL   3,READMET
         BCT   9,READH
         LA      8,METREC
         L       9,DAYSNOW
READRE2  BAL     3,READMET
         LA      8,20(8)
         BCT     9,READRE2
         LA      6,0
*
         L     2,ARCHIVAD
         L     10,SOILMATA
         LA    11,3024
         MVI   DARCH,X'7F'
         MVI   UPDATREC,X'7F'
         MVI   WNEWARCH,X'7F'
*
TESTSOIL CLI   0(10),X'00'
         BE    ZEROSOIL
*
         BAL   3,READARCH
         CR      5,6
         BNE     SKIPMET
         LA      8,METREC
         L       9,DAYSNOW
READREC  BAL     3,READMET
```

```
         LA      8,20(8)
         BCT     9,READREC
         LA      6,0
*
*
SKIPMET  L       7,METDAYAD
         LA      6,1(0,6)
         LA      8,METREC
         L       9,DAYSNOW
*
MOVEMET  MVC     0(20,7),0(8)
*
CALLDLY  L       15,DAILYADD
         BALR    14,15
         BAL     3,WRITARCH
         LA      8,20(8)
         BCT     9,MOVEMET
*
         BAL     3,UPDATE
         LA      10,2(10)
         BCT     11,TESTSOIL
*
RETURN   L       13,4(13)
         RETURN  (14,12),RC=0
*
ZEROSOIL LA      2,DUMMY
         CR      5,6
         BNE     CONTINUE
         LA      8,METREC
         L       9,DAYSNOW
NEXT     BAL     3,READMET
         LA      8,20(8)
         BCT     9,NEXT
         LA      6,0
CONTINUE LA      6,1(0,6)
         L       4,DAYSNOW
*
PUTZREC  BAL     3,WRITARCH
         BCT     4,PUTZREC
         BAL     3,UPDATE
         L       2,ARCHIVAD
         LA      10,2(10)
         BAL     3,READARCH
         BCT     11,TESTSOIL
         B       RETURN
*
READARCH READ    DARCH,SF,ARCHIVE,(2),'S'
         CHECK   DARCH
         BR      3
```

```
*
WRITARCH WRITE WNEWARCH,SF,NEWARCH,(2),'S'
         CHECK WNEWARCH
         BR    3
*
UPDATE   WRITE UPDATREC,SF,TEMPARCH,(2),'S'
         CHECK UPDATREC
         BR    3
*
READMET  READ DMET,SF,METFILE,(8),'S'
         CHECK DMET
         BR    3
*
ARCHIVE  DCB   DSORG=PS,MACRF=R,DDNAME=ARCHIVE
*
NEWARCH  DCB   DSORG=PS,MACRF=W,DDNAME=NEWARCH
*
TEMPARCH DCB   DSORG=PS,MACRF=W,DDNAME=TEMPARCH
*
METFILE  DCB   DSORG=PS,MACRF=RC,DDNAME=METFILE
*
F20      DC    F'20'
F28      DC    F'28'
F206     DC    F'206'
F334     DC    F'334'
F756     DC    F'756'
ARCHIVAD DC    V(ARCHIV)
DAILYADD DC    V(DAILY)
IBCOM#AD DC    V(IBCOM#)
METDAYAD DC    V(METDAY)
OPENAGAD DC    V(OPENAG)
SOILMATA DC    V(SLASG)
*
OLDMET   DC    F'0'
DUMMY    DC    108X'FF'
METREC   DS    0D
         DC    20XL20'00'
         END
```

```
      SUBROUTINE SMTBGT
      INTEGER*2 NDAY(5),CRPDAY,TSOIL,RAD
      INTEGER*2 SOILC(3,27)/5*1,3,1,1,4,1,3,1,1,3,3,1,3,4,1,4,1,1,4,3,
     X1,4,4,3,1,1,3,1,3,3,1,4,3,3,1,5*3,4,3,4,1,3,4,3,3,4,4,
     X4,1,1,4,1,3,4,1,4,4,3,1,4,3,3,4,3,3*4,1,4,4,3,3*4/
      INTEGER SOIL,S(3)
      REAL SM(3),ET(3),STRINT(5),FCL(3,6)
      REAL INFILT,C(3)                                                  0
      DATA FACTOR/0.0522298/
      REAL C1(3,6)/.6,.2,0.,.6,.2,0.,.55,.3,0.,.4,.35,.15,.45,.35,.2,
     X .45,.35,.1/
      DATA FCL/8.75,35.,131.25,8.75,35.,131.25,5.75,23.0,86.25,         0
     X3.75,15.,56.25,8.75,35.,131.25,3*0./
      COMMON/PHYS/SOIL
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,TMAX,
     X TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
      IBMT=BMT+2.0
      IF(IBMT.GT.6.OR.IBMT.LT.1) IBMT=1
      DO 10 I2=1,3
      C(I2)=C1(I2,IBMT)
      S(I2)=SOILC(I2,SOIL)
10    CONTINUE
      IF(BMT.LE.1.5) GO TO 100
      C(2)=C(2)*(1.+C(1)*(1.-SM(1)/FCL(1,S(1))))
      C(3)=C(3)*(1.+C(1)*(1.-SM(1)/FCL(1,S(1)))
     X              +C(2)*(1.-SM(2)/FCL(2,S(2))))
  100 CONTINUE                                                          0
      ETS=0.
C        FOLLOWING CALCULATION ASSUMES A MODEL START OF 1 JUNE
C        AND MODIFIES ETPAVE ACCORDINGLY
      IF(JUL.LT.152) JUL=152
      IF(JUL-161) 110,120,120
110   ND=JUL-152
      NT=ND+1
      F1=FLOAT(ND)/FLOAT(NT)
      F2=1./FLOAT(NT)
      ETPAVE=F1*ETPAVE+F2*ETP
      GO TO 130
120   ETPAVE=0.9*ETPAVE+0.1*ETP
C
130   DEVETP=ETP-ETPAVE
      DO 200 L=1,3
      DC=1.0
      IF(S(L).EQ.3) GO TO 150
      X=70.-100.*(SM(L)/FCL(L,S(L)))
      DC=1.0/(1.0+EXP(FACTOR*X))
      IF(X.LT.0.) DC=1.0
150   ET(L)=C(L)*DC*ETP*EXP(-.01*DEVETP*(7.91-11.0*SM(L)/FCL(L,S(L))))
      IF(ET(L).GT.SM(L)) ET(L)=SM(L)
```

```
      ETS=ETS+ET(L)
  200 CONTINUE
      IF(ETS.LE.ETP) GO TO 205
      DO 204 L=1,3
204   ET(L)=ET(L)*ETP/ETS
  205 CONTINUE
      PCPINH=PRECIP*0.03937
      IF(PCPINH.GT.0.5) GOTO 210
      INFILT=PCPINH
      GOTO 230
  210 CONTINUE
      IF(PCPINH.GE.1.0) GOTO 220
      INFILT=(PCPINH-0.5)*0.8354+0.5
      GOTO 230
  220 CONTINUE
      INFILT=0.9177+ALOG(PCPINH)*(1.811-0.97*SM(1)/FCL(1,S(1)))
  230 CONTINUE
      INFILT=INFILT/.03937
      IF(INFILT.GT.PRECIP) INFILT=PRECIP
      EXCESS=INFILT
      DO 500 L=1,3
      SM(L)=SM(L)+EXCESS-ET(L)
      EXCESS=SM(L)-FCL(L,S(L))
      IF(EXCESS.LT.0.0) EXCESS=0.0
      IF(L.EQ.3) RUNOFF=PRECIP-INFILT+EXCESS
      IF(SM(L).GE.0.0) GO TO 300
      SM(L)=0.0
      GOTO 400
  300 CONTINUE
      IF(SM(L).GT.FCL(L,S(L))) SM(L)=FCL(L,S(L))
  400 CONTINUE
  500 CONTINUE
      STR=0.
      CRNOFF=CRNOFF+RUNOFF
      IF(BMT.LE.-0.5) GO TO 2700
      IF(ETP.GT.0.0) STRESS=1.0-ETS/ETP
 2700 RETURN
      END
```

```
      SUBROUTINE OPENAG
      INTEGER*2 SALAT(4,28,27),SLMAT(4,28,27),SLEQ(3024)
      INTEGER*2 STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT,LAT1
      REAL LAT,LON
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,CRD,SOIL,
     XPLNDAT,TSTSIT
      COMMON/SLASG/SLMAT,SALAT
      EQUIVALENCE (SLMAT,SLEQ)
      CALL HSTOPN(II)
      DO 100 I=1,3024
      CALL HSTRD(I)
      IJ=IFIX(LAT*10.)
      LAT1=IJ
      I1=II-205
      J1=JJ-334
      SLMAT(KK,J1,I1)=SOIL*256+PLNDAT
      SALAT(KK,J1,I1)=LAT1
100   CONTINUE
      CALL HSTCLS
      RETURN
      END
```

```
      SUBROUTINE DAILY
      INTEGER*2 NDAY(5),CRPDAY,TSOIL,MAXT,MINT,RAD,
     X BMT1,RNET,PET,SOLAR,I1,J1,PREC
      INTEGER*2 SALAT(4,28,27),SLMAT(4,28,27)
      INTEGER*2 IDM,IDT
      INTEGER PLNDAT,SOIL
      REAL BMT,SM(3),ET(3),ETP,ETPAVE,PRECIP,STRESS,STRINT(5)
      DATA R/0.0174532925/
      COMMON/TEMPF/DAYLEN,TMAXF,TMINF,PLNDAT
      COMMON/SLASG/SLMAT,SALAT
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,TMAX,
     X TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
      COMMON/PHYS/SOIL
      COMMON/METDAY/I1,J1,PREC,PET,RNET,SOLAR,MAXT,MINT,BMT1,IDM
      I2=I-205
      J2=J-334
      K2=K
      LAT=SALAT(K,J2,I2)
      XLAT=FLOAT(LAT)/10.
      I3=SLMAT(K,J2,I2)
      SOIL=I3/256
      PLNDAT=MOD(I3,256)
      IF(JUL.NE.152.OR.SOIL.NE.27) GO TO 10
      TS=SM(1)+SM(2)+SM(3)
      SM(1)=0.05*TS
      SM(2)=0.2*TS
      SM(3)=TS*0.75
10    MT=MAXT
      TMAX=FLOAT(MT)/10.
      TMAXF=1.8*TMAX+32.
      MT=MINT
      TMIN=FLOAT(MT)/10.
      TMINF=1.8*TMIN+32.
      RAD=RNET
C
C        CALCULATE DAYLENGTH
C
      JUL=JUL+1
      DAY=JUL
      FPH=23.5*SIN(0.9863*(DAY-80.)*R)
      COH=-TAN(XLAT*R)*TAN(FPH*R)
      DAYLEN=ARCOS(COH)*7.6408787
C
C        CALCULATE NEW BMT VALUE
C
      CALL BMTDAY
C
      MT=PET
      ETP=FLOAT(MT)/10.
```

```
      MT=PREC
      PRECIP=FLOAT(MT)/10.
      IBMT=IFIX(BMT)+1
C
C        CALCULATE SOIL MOISTURE AND PLANT STRESS
C
      CALL SMTBGT
C
C        DAY'S GROWTH COMPLETE - RETURN
C
      IF(IBMT.LT.1.OR.IBMT.GT.5) GO TO 20
      NDAY(IBMT)=NDAY(IBMT)+1
      STRINT(IBMT)=STRINT(IBMT)+STRESS
20    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE BMTDAY
      INTEGER PLNDAT
      REAL SM(3),FT(3),STRINT(5)
      INTEGER*2 NDAY(5),CRPDAY,TSOIL,RAD
      COMMON/TEMPF/DAYLEN,TMAXF,TMINF,PLNDAT
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,TMA
     X TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
C
C     INITIALIZE
C     CLEAR THE V1 PART OF THE EQUATION.
C     SET THE RESULTING BMTNEW TO -1 IF THE DATE IS BEFORE
C     THE PLANTING DATE AND EXIT.
C     SET THE RESULTING BMTNEW TO 0 IFTHE DATE IS THE
C     PLANTING DATE AND EXIT.
C
      V1=0.0
      IF(JUL-PLNDAT) 10,20,30
   10 CONTINUE
      BMT=-1.0
      GOTO 900
   20 CONTINUE
      CRPDAY=1
      BMT=0.0
      GOTO 900
   30 CONTINUE
C
C     SELECT THE PROPER COEFFICIENTS BASED ON THE PREVIOUS BMT.
C     SET V1 TO 1 FOR THE 'A' COEFFICIENTS ON THE FIRST SET.
C     IF BMT IS > OR = TO 5.0 THEN SET IT TO 5 AND EXIT.
C
      IBMT=IFIX(BMT+2.0)
      GO TO (900,40,50,60,70,80,900),IBMT
   40 CONTINUE
      B0=44.37
      B1=0.01086
      B2=-0.000223
      B3=0.009732
      B4=-0.0002267
      V1=1.0
      GOTO 90
   50 CONTINUE
      A0=8.413
      A1=1.005
      A2=0.0
      B0=23.64
      B1=-0.003512
      B2=0.00005026
      B3=0.0003666
      B4=-0.000004282
```

```
      GOTO 90
   60 CONTINUE
      A0=10.93
      A1=0.9256
      A2=-0.06025
      B0=42.65
      B1=0.0002958
      B2=0.0
      B3=0.0003943
      B4=0.0
      GOTO 90
   70 CONTINUE
      A0=10.93
      A1=1.389
      A2=-0.08191
      B0=42.18
      B1=0.0002458
      B2=0.0
      B3=0.00003109
      B4=0.0
      GOTO 90
   80 CONTINUE
      A0=24.38
      A1=-1.14
      A2=0.0
      B0=37.67
      B1=0.00006733
      B2=0.0
      B3=0.0003442
      B4=0.0
   90 CONTINUE
      IF(TMAXF.LT.B0) TMAXF=B0
      IF(TMINF.LT.B0) TMINF=B0
      D=DAYLEN-A0
      TMX=TMAXF-B0
      TMN=TMINF-B0
      IF(V1.EQ.1.0) GOTO 100
      V1=D*(A1+A2*D)
      IF(V1.LT.0.0) V1=0.0
  100 CONTINUE
      V2=TMX*(B1+B2*TMX)
      IF(V2.LT.0.0) V2=0.0
      V3=TMN*(B3+B4*TMN)
      IF(V3.LT.0.0) V3=0.0
      BDAY=V1*(V2+V3)
      BMT=BDAY+BMT
      CRPDAY=CRPDAY+1
  900 CONTINUE
      IF(BMT.GE.5.0) BMT=-1.0
      RETURN
      END
```

5.2.2 DAYRUN

5.2.2.1 Functional Description

The program DAYRUN produces the following:

1. A listing by ijk cell of all status information for each cell.
2. Maps of selected parameters, selected cells for the test area of interest.

These functions are performed on a daily basis and are the verification mechanism for agronomic growth.

5.2.2.2 Mathematical Description

- none -

5.2.2.3 DAYRUN EXECUTION

Job Control Language

```
//DAYRUN JOB  (BR9001,746),ANDERSON,CLASS=F
//SORTAG EXEC PGM=IERRC000,PARM='MSG=AP',REGION=80K
//*
//* AGRONOMIC DATA SORT FOR INPUT TO DAILY LISTING
//*
//SYSOUT DD SYSOUT=A
//SYSPRINT DD SYSOUT=A
//SORTLIB DD DSNAME=SYS1.SORTLIB,DISP=SHR
//SORTIN DD DSN=NEW,DISP=(OLD,DELETE),
//            DCB=(RECFM=F,BLKSIZE=108)
//SORTOUT DD DSN=&&AG,DISP=(NEW,PASS),
// UNIT=SYSDA,SPACE=(CYL,(10,4)),DCB=(RECFM=F,BLKSIEE=108)
//SORTWK01 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK02 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK03 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK04 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SORTWK05 DD UNIT=2314,SPACE=(CYL,(5),,CONTIG)
//SYSIN DD *
 SORT FIELDS=(13,4,A,1,4,A,5,4,A,9,4,A),FORMAT=BI      (See Note)

//DAYRUN EXEC FORTGCLG,PARM.FORT='MAP,ID'
//*
//*     LOAD MODULE DAYRUN
//*
//FORT.SYSIN DD *
```

- Fortran Source Deck -

```
//LKED.SYSLIB DD
//             DD DSN=EARTH.LOADLIB,DISP=SHR
//GO.FT05F001  DD DDNAME=SYSIN
//FT06F001     DD SYSOUT=A
//FT10F001 DD SYSOUT=C,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330),
//    SPACE=(CYL,(30,10),RLSE)
//FT09F001 DD *
```

FT09F001 data cards

```
//FT29F001 DD DSN=&&AG,DISP=(OLD,DELETE,KEEP)
//SYSIN DD *
```

FT05F001 data cards

```
/*
//
```

Data Definition Description

GO STEP

FT05F001: Map overlay data for output display.

FT06F001: Map print file.

FT09F001: Days to process in I2 format.

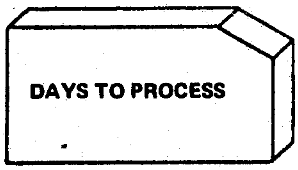
FT10F001: I, J listing print file.

FT29F001: Sorted agronomic daily status file.

NOTE: Data card for IBM Sort/Merge program, in this case sorts the data by Julian date, I, J, K. Reference publications is OS Sort/Merge Program release 21.

5.2.2.4 DATA DESCRIPTION

FT09F001



1 CARD

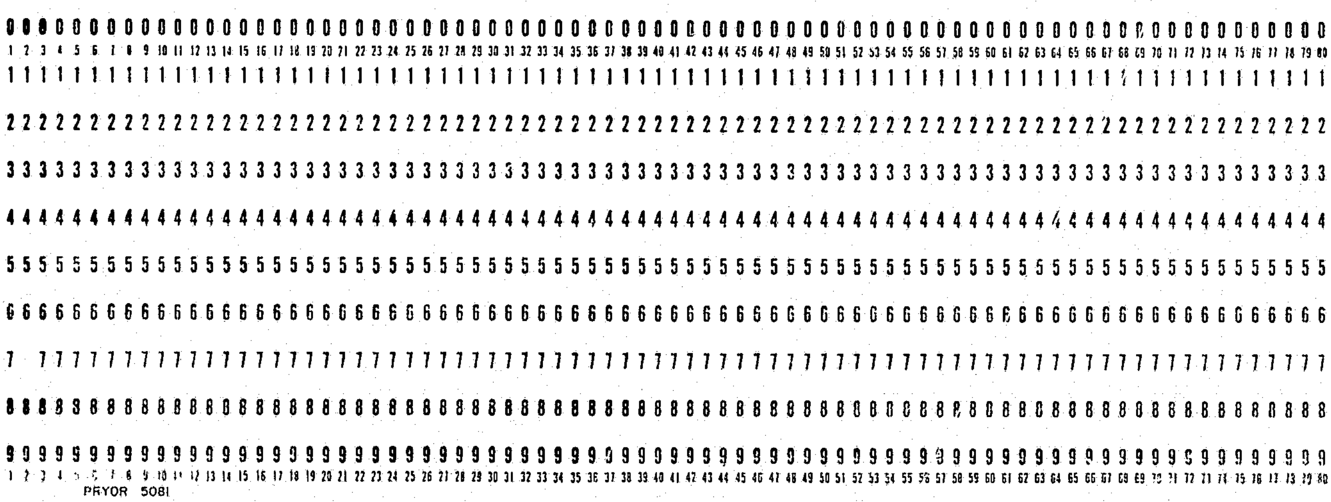
PROCESSING DAYS DATA CARD

PROCESSING DAYS - DATA CARD

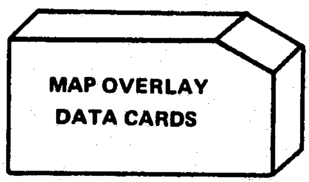
FORMAT: (I2)

Variable	Format	Cols	Description
NDAYS	I2	1-2	Number of Days in present run to be listed

SAMPLE CARD:



FT05F001 DATA CARDS



102 CARDS

MAP OVERLAY DATA CARD

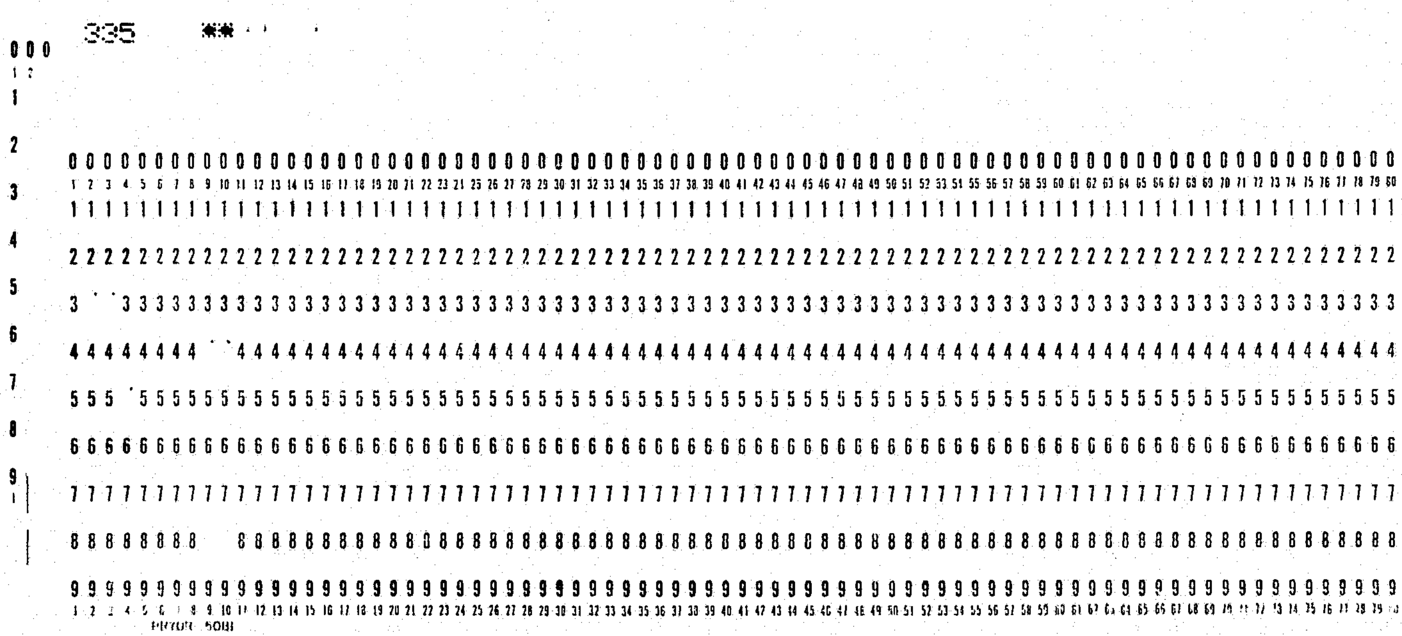
MAP OVERLAY - DATA CARD

FORMAT: (80A1/20A1)

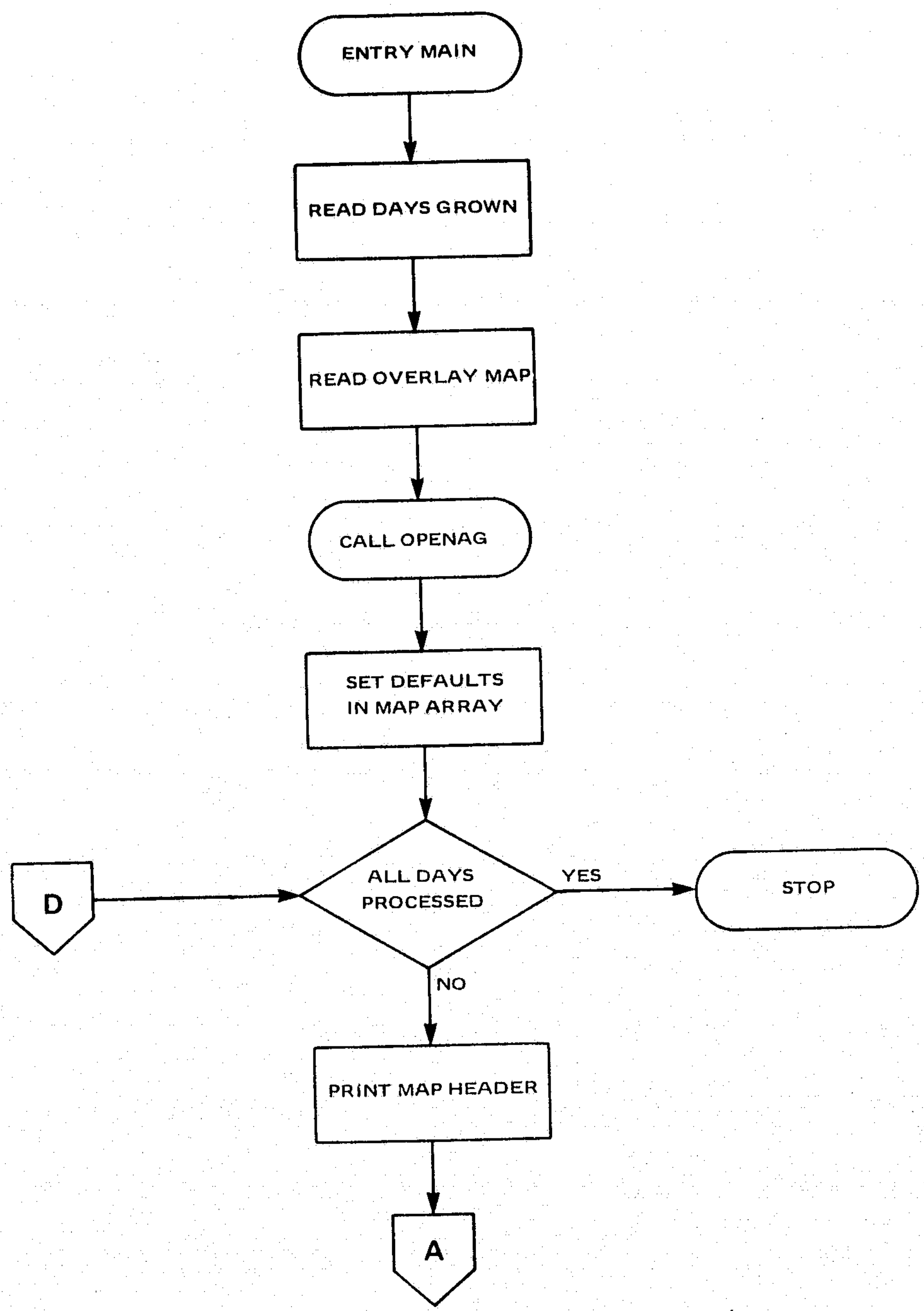
Note: Format requires two cards per line

Variable	Format	Cols	Description
OVLY (I,J)	80 A1	1-80	Output line masked with area boundaries
.			
.			
.	Card #2		
OVLY (I+80,J)	20 A1	1-20	Output line continued

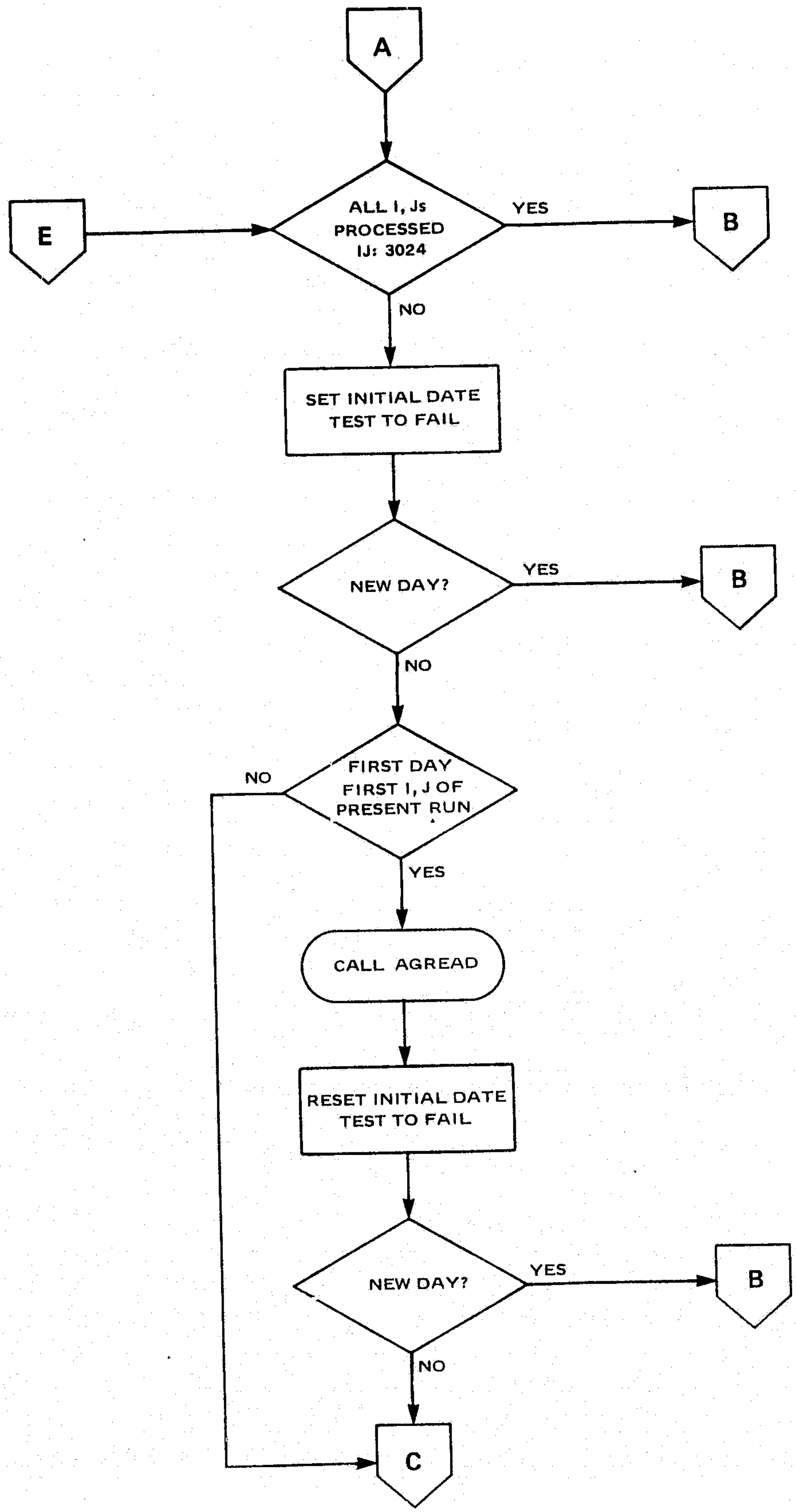
SAMPLE CARD:



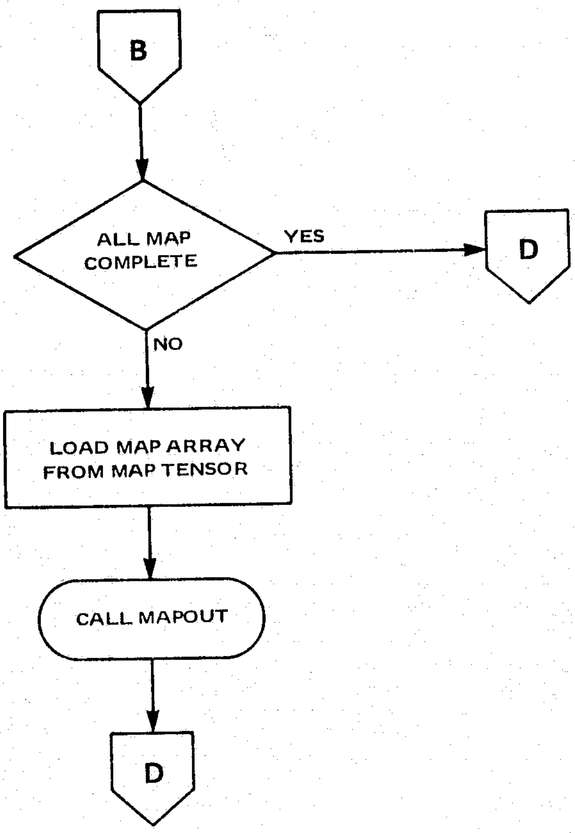
5.2.2.5 FLOWCHART DAYRUN



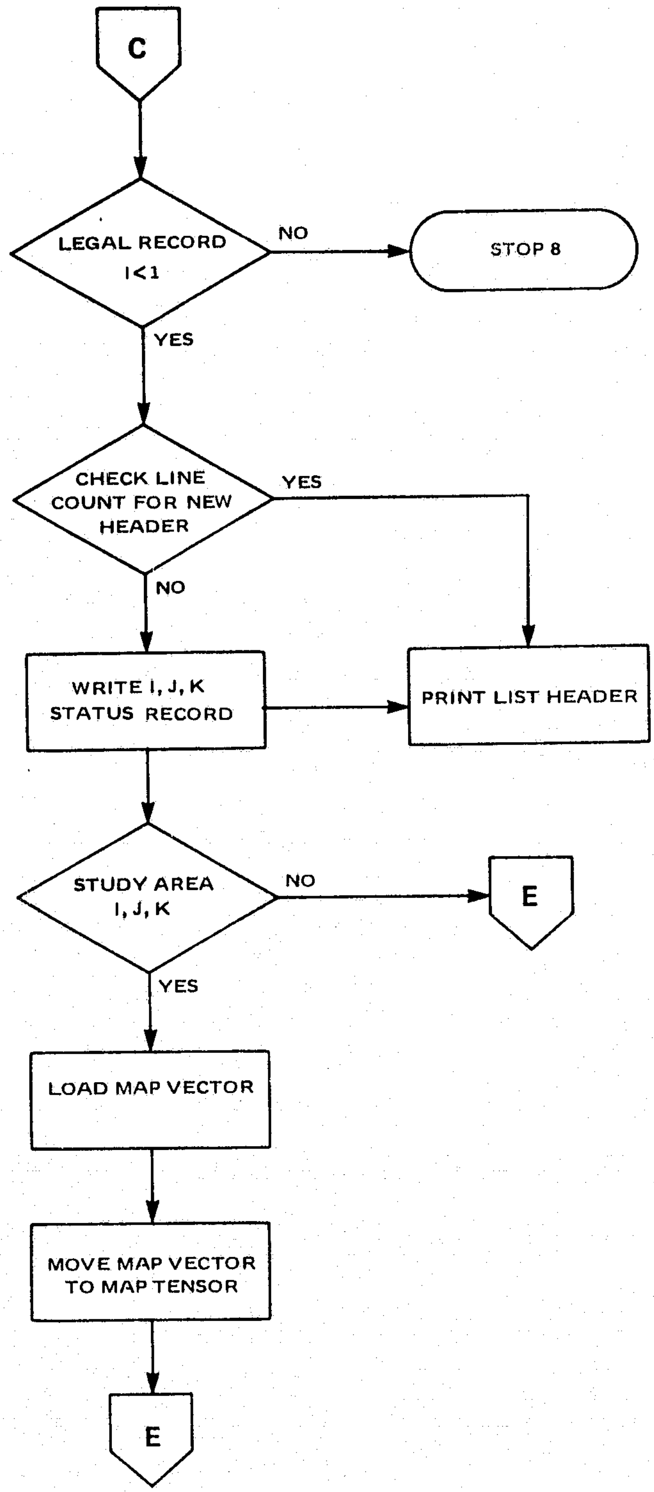
DAYRUN


A
E
ALL I, Js
PROCESSED
IJ: 3024
YES
B
NO
SET INITIAL DATE
TEST TO FAIL
NEW DAY?
YES
B
NO
FIRST DAY
FIRST I, J OF
PRESENT RUN
NO
YES
CALL AGREAD
RESET INITIAL DATE
TEST TO FAIL
NEW DAY?
YES
B
NO
C

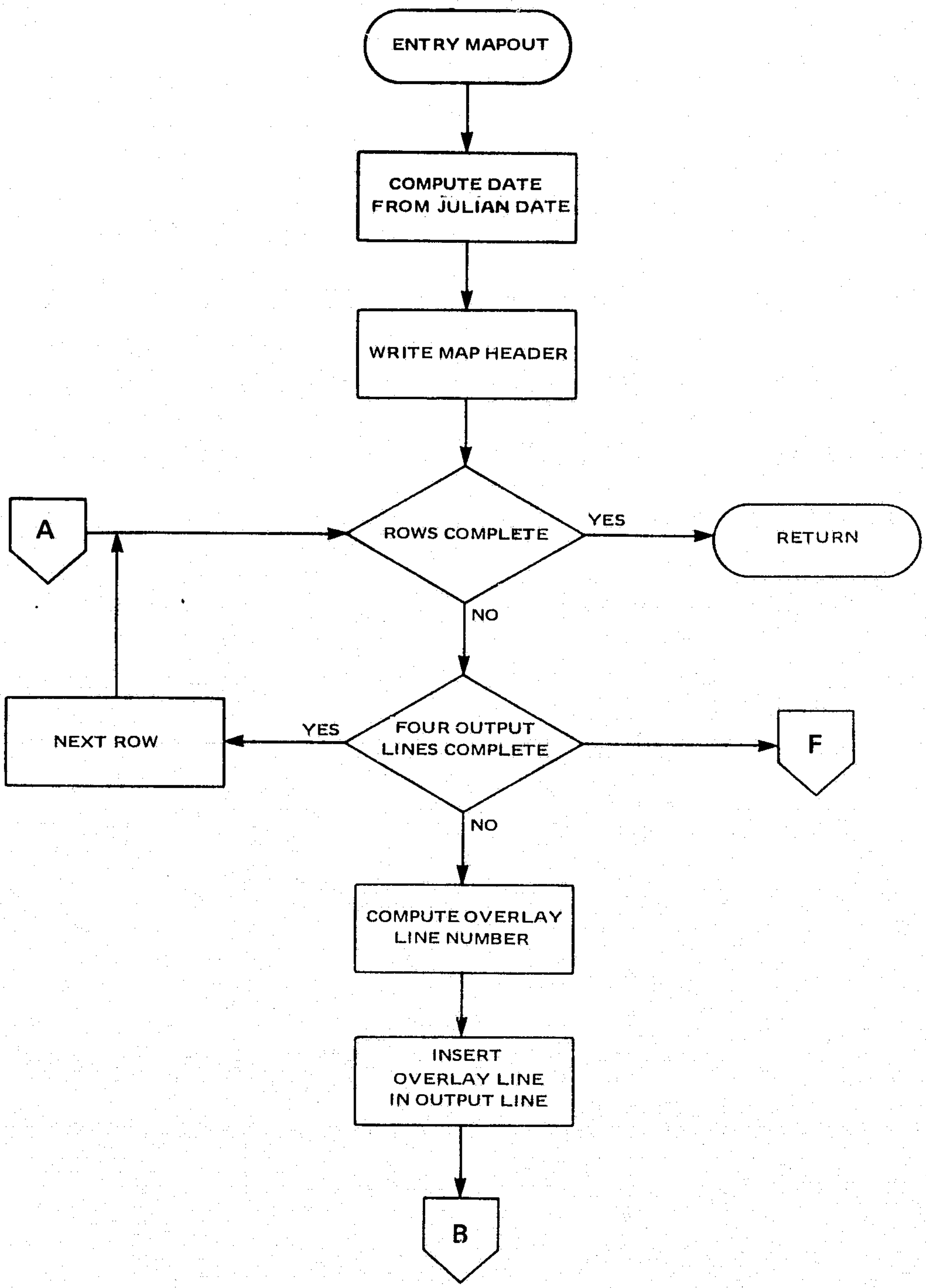
DAYRUN

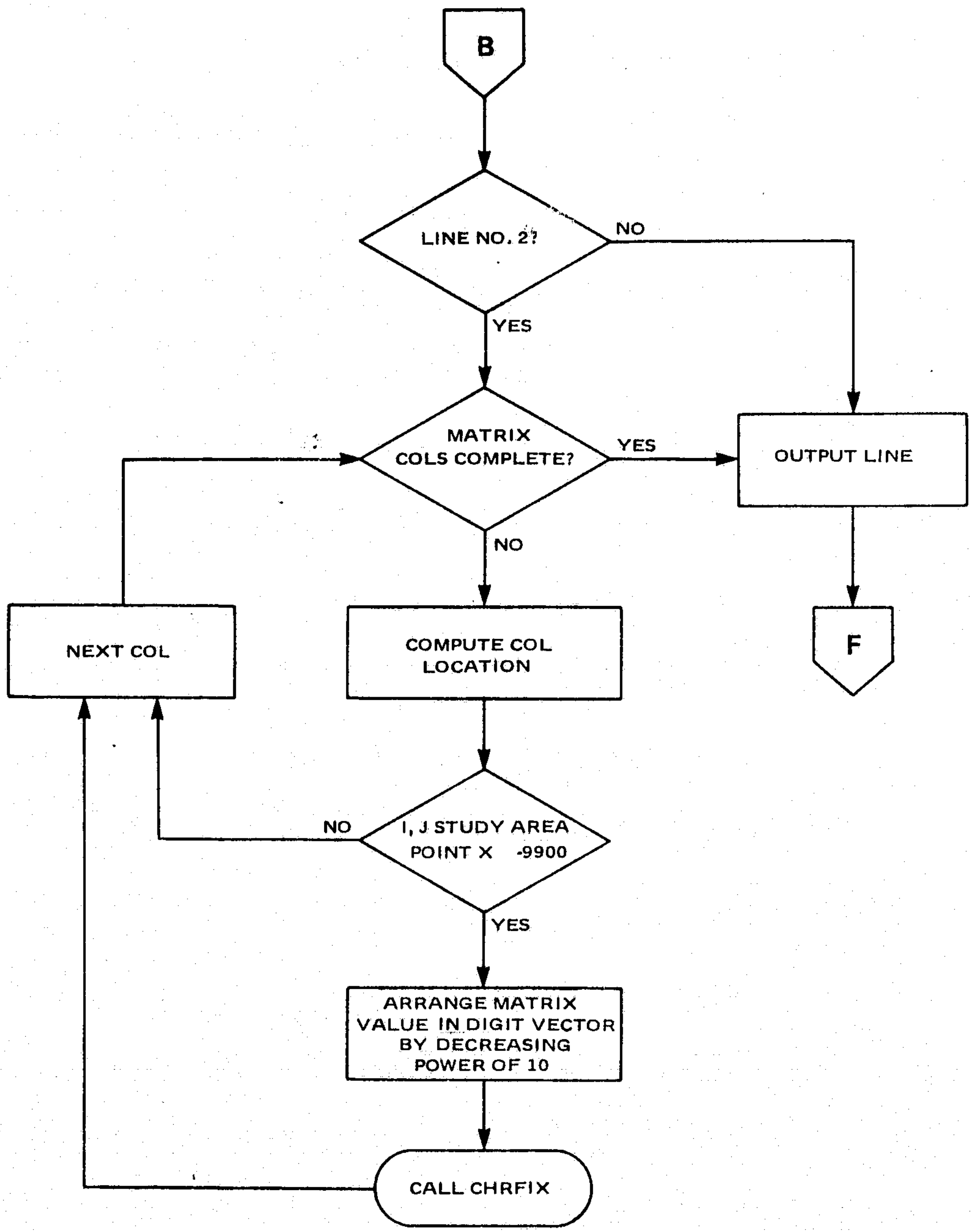

B
ALL MAP COMPLETE
YES
D
NO
LOAD MAP ARRAY FROM MAP TENSOR
CALL MAPOUT
D

DAYRUN

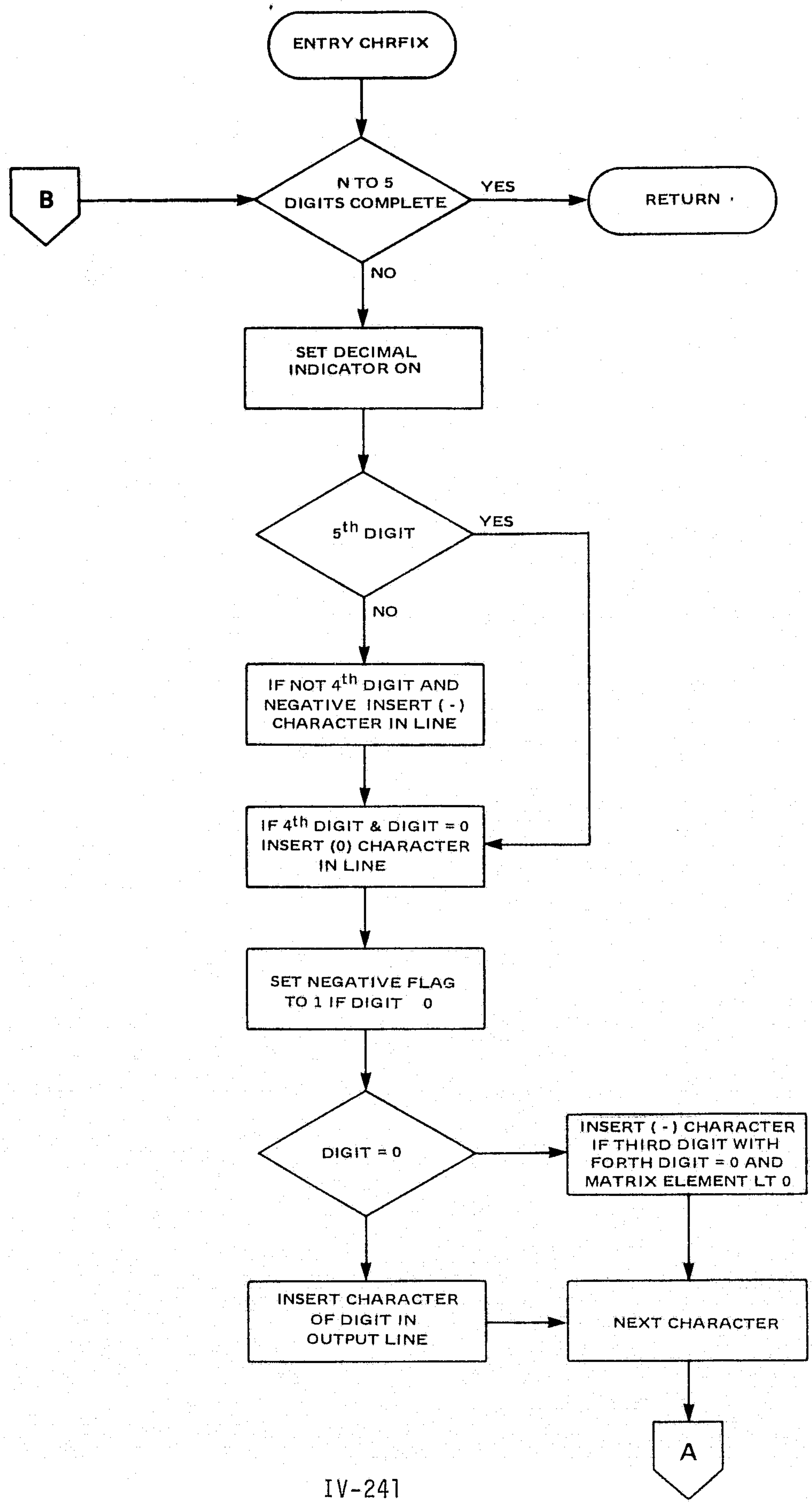

C
LEGAL RECORD
I<1
NO
STOP 8
YES
CHECK LINE
COUNT FOR NEW
HEADER
YES
NO
WRITE I, J, K
STATUS RECORD
PRINT LIST HEADER
STUDY AREA
I, J, K
NO
E
YES
LOAD MAP VECTOR
MOVE MAP VECTOR
TO MAP TENSOR
E

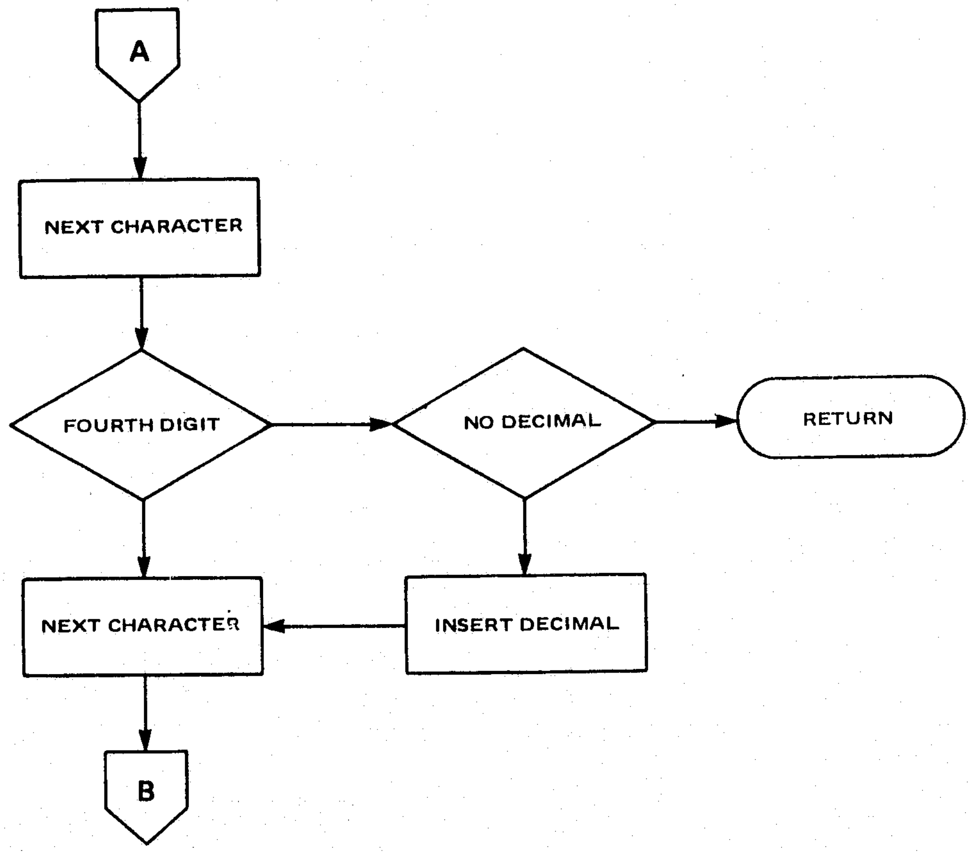
SUBROUTINE MAPOUT




B
LINE NO. 2?
NO
YES
MATRIX COLS COMPLETE?
YES
OUTPUT LINE
NO
F
NEXT COL
COMPUTE COL LOCATION
NO
I, J STUDY AREA POINT X -9900
YES
ARRANGE MATRIX VALUE IN DIGIT VECTOR BY DECREASING POWER OF 10
CALL CHRFIX

SUBROUTINE CHRFIX




A
NEXT CHARACTER
FOURTH DIGIT
NO DECIMAL
RETURN
NEXT CHARACTER
INSERT DECIMAL
B

5.2.2.5 SOURCE CODE

```
      INTEGER*2 OVLY(101,56),NDAY(5),CRPDAY,TSOIL,RAD
      INTEGER*2 A(14,14),B(14,14,8),V(8)
      REAL SM(3),ET(3),STRINT(5)
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,TMAX,
     X TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
      COMMON /MAP/OVLY
      READ(9,1999) NDAYS
1999  FORMAT(I2)
      READ(5,2000) OVLY
2000  FORMAT(80A1/21A1)
      CALL OPENAG
      DO 500 IJK=1,NDAYS
      JULD=-999
      DO 20 N=1,8
      DO 10 L=1,14
      DO 10 M=1,14
10    B(L,M,N)=-9999
20    CONTINUE
      NPTS=0
      WRITE(10,2003)
      WRITE(10,2004)
      WRITE(10,2002)
      DO 100 IJ=1,3024
      IF(IJ.EQ.1) JUL6=JUL
      IF(JUL6.NE.JUL) GO TO 556
      IF(IJ.EQ.1.AND.IJK.NE.1) GO TO 555
      CALL AGREAD(I)
      IF (IJ.EQ.1) JUL6=JUL
      IF(JUL6.NE.JUL) GO TO 556
555   CONTINUE
      IF(I.LT.1)STOP 8
      NPTS=NPTS+1
      IF (NPTS.LT.18)GO TO 25
      NPTS=0
      WRITE(10,2003)
      WRITE(10,2004)
      WRITE(10,2002)
25    WRITE(10,2001) I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,
     X TMAX,TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
2001  FORMAT(/,1X,4I4,F5.2,8F6.1,F6.2,3F6.1,F8.1,/,12X,5F7.2,8I5)
2002  FORMAT(1X,/,1X,' COL ROW 1/4 JUL BMT   SM(1) SM(2) SM(3)  ET(1)',
     X' ET(2) ET(3)  ETP  ETPAV PREC   STR  TMAX  TMIN  CRNOFF ',/,
     X13X,' STRS1  STRS2  STRS3  STRS4  STRS5  ND1  ND2  ND3  ND4',
     ?'  ND5  CRPD TSIT RAD',/)
2003  FORMAT('1',51X,'EARTHSAT')
2004  FORMAT(39X,'DAILY WEATHER/STRESS CELL STATUS'//)
28    CONTINUE
```

```
      L=MOD(I,2)
      IF(L.EQ.1) GO TO 100
      L=MOD(J,2)
      IF(L.NE.1) GO TO 100
      IF(JUL.GT.JULD) JULD=JUL
      JUL6=JUL
      I1=I-205
      J1=J-334
      V(1)=(SM(1)+SM(2)+SM(3))*10.
      V(2)=PRECIP*10.
      V(3)=ETP*10.
      V(4)=(ETP-(ET(1)+ET(2)+ET(3)))*10.
      V(5)=BMT*10.
      V(6)=RAD*10
      V(7)=TMAX*10.
      V(8)=TMIN*10.
      I1=((I1-1)/2)+1
      J1=((J1-1)/2)+1
      DO 30 L=1,8
30    B(I1,J1,L)=V(L)
100   CONTINUE
 556  CONTINUE
      DO 200 INJB=1,8
      DO 150 JPB=1,14
      DO 150 MEB=1,14
150   A(JPB,MEB)=B(JPB,MEB,INJB)
      CALL MAPOUT(INJB,A,JULD)
200   CONTINUE
500   CONTINUE
      STOP
      END
```

```
      SUBROUTINE MAPOUT(N,IVAL,JDAY)
      REAL*8 TITLE(8)/'TSOILMST','PRECIP','ETP','ETP-ET','BMT','RNET',
     *  'MAX TEMP','MIN TEMP'/
      REAL*8 AMON(6)/'   APRIL','     MAY','    JUNE','    JULY',
     *  '  AUGUST','   SEPT.'/
      INTEGER*4          NDAYS(6)/90,120,151,181,212,243/
      INTEGER*2 OVLY(101,56),IVAL(14,14),LINE(101),LVAL(5),JVAL
      COMMON /MAP/ OVLY
      DO 10 I=1,6
      NDAY=JDAY-NDAYS(I)
      IF(NDAY) 20,20,10
   10 CONTINUE
      I=I+1
   20 I=I-1
      NDAY=JDAY-NDAYS(I)
      WRITE(6,1000) TITLE(N),AMON(I),NDAY
 1000 FORMAT(1H1,37X,A8,4X,A8,I3,', 1975',40X,'EARTH SATELLITE CORP.'//'
     *        206     208     210     2',
     *12      214     216     218     220     222     224     226     228     230
     *    232'/)
      DO 80 I=1,14
      DO 80 J=1, 4
      L=(I-1)*4+J
      DO 30 K=1,101
   30 LINE(K)=OVLY(K,L)
      GO TO (70,40,70,70),J
   40 DO 60 K=1,14
      KC1=(K-1)*7+6
      JVAL=IVAL(K,I)
      IF(JVAL.LT.-9900) GO TO 60
      DO 50 KK=1,4
      LVAL(KK)=JVAL/10**(5-KK)
   50 JVAL=JVAL-LVAL(KK)*10**(5-KK)
      LVAL(5)=JVAL
      NST=3
      IF(N.LT.3) NST=2
      IF(N.GT.6) NST=2
      IF(N.EQ.6) NST=1
      IDEC=1
      IF(N.EQ.6) IDEC=0
      CALL CHRFIX(LINE,KC1,LVAL,NST,IDEC)
   60 CONTINUE
   70 WRITE(6,2000) LINE
 2000 FORMAT(101A1)
   80 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CHRFIX(LINE,K1,L,N,ID)
      INTEGER*2 LINE(101),L(5),NUM(10)/'0','1','2','3','4','5','6','7',
     * '8','9'/,IMIN/'-'/,IDEC/'.'/
      LN=0
      LM=0
      IC=K1
      DO 40 I=N,5
      IF(I.EQ.4) LN=1
      IF(I.EQ.5) GO TO 10
      IF(LN.EQ.0.AND.L(I+1).LT.0) LINE(IC)=IMIN
   10 IF(L(I).EQ.0.AND.LN.NE.0) LINE(IC)=NUM(1)
      IF(L(I).LT.0) LM=1
      IF(L(I).EQ.0) GO TO 20
      LN=1
      LL=L(I)
      LINE(IC)=NUM(IABS(LL   )+1)
      GO TO 30
   20 IF(LN.EQ.0.AND.I.EQ.3.AND.L(4).EQ.0.AND.L(5).LT.0) LINE(IC)=IMIN
   30 IC=IC+1
      IF(I.NE.4) GO TO 40
      IF(ID   .EQ.0) RETURN
      LINE(IC)=IDEC
      IC=IC+1
   40 CONTINUE
   50 RETURN
      END
```

5.2.2.7 DAYRUN SAMPLE OUTPUT

CCL	ROW	1/4	JUL BMT	SM(1)	SM(2)	SM(3)	ET(1)	ET(2)	ET(3)	ETP	ETPAV	PREC	STR	TMAX	TMIN	CRNOFF
			STRS1	STRS2	STRS3	STRS4	STRS5	ND1	ND2	ND3	ND4	ND5 CRPU	ISIT	RAD		
218	343	1	237-1.00	5.8	12.1	38.6	3.2	0.1	0.0	5.4	5.5	0.30	0.9	17.3	10.7	3.4
			3.61	9.53	8.17	14.53	7.10	10	20	17	20	9 77	0	211		
218	343	2	237-1.00	5.8	12.1	38.6	3.2	0.1	0.0	5.4	5.5	0.30	0.8	17.3	10.7	3.4
			3.61	9.53	8.17	14.53	7.94	10	20	17	20	10 78	0	211		
218	343	3	237-1.00	5.8	12.1	38.8	3.2	0.1	0.0	5.4	5.5	0.30	0.9	17.3	10.7	3.4
			3.61	9.53	8.17	13.67	7.99	10	20	17	19	10 77	0	211		
218	343	4	237-1.00	5.8	12.1	38.8	3.2	0.1	0.0	5.4	5.5	0.30	0.9	17.3	10.7	3.4
			3.61	9.53	8.17	13.67	7.99	10	20	17	19	10 77	0	211		
218	344	1	237-1.00	5.9	8.2	74.2	3.1	0.1	0.0	5.2	5.3	0.30	0.8	17.3	10.8	3.9
			3.96	6.13	5.21	11.74	8.18	8	19	19	20	11 78	0	202		
218	344	2	237-1.00	5.9	8.6	33.5	3.1	0.1	0.0	5.2	5.3	0.30	0.9	17.3	10.8	3.3
			3.61	10.22	7.32	14.21	7.13	10	20	18	19	9 77	0	202		
218	344	3	237-1.00	5.9	8.6	33.4	3.1	0.1	0.0	5.2	5.3	0.30	0.9	17.3	10.8	3.3
			3.61	10.22	6.93	14.60	7.13	10	20	17	20	9 77	0	202		
218	344	4	237-1.00	5.9	8.6	33.7	3.1	0.1	0.0	5.2	5.3	0.30	0.8	17.3	10.8	3.3
			3.61	10.22	6.93	13.76	7.14	10	20	17	19	9 76	0	202		
218	345	1	237-1.00	5.3	7.0	67.5	3.4	0.1	0.0	5.7	5.5	0.0	0.9	17.3	10.8	3.5
			4.36	7.21	4.28	13.12	7.77	10	19	18	19	11 78	0	243		
218	345	2	237-1.00	2.3	0.0	0.0	3.4	0.4	0.0	5.7	5.5	0.0	1.0	17.3	10.8	3.2
			4.26	5.80	2.47	11.08	8.46	10	19	18	19	11 78	0	243		
218	345	3	237-1.00	5.3	6.9	37.5	3.4	0.1	0.0	5.7	5.5	0.0	0.9	17.3	10.8	3.5
			3.61	10.25	6.79	14.45	7.07	10	20	18	19	9 77	0	243		
218	345	4	237-1.00	5.3	7.2	68.4	3.4	0.1	0.0	5.7	5.5	0.0	0.5	17.3	10.8	3.5
			4.36	7.21	4.28	12.34	7.23	10	19	18	18	10 76	0	243		
218	346	1	237-1.00	2.0	0.0	0.0	3.8	0.4	0.0	6.2	5.6	0.0	1.0	17.5	11.3	3.3
			3.93	5.91	3.05	12.22	8.43	10	19	18	19	11 78	0	244		
218	346	2	237-1.00	2.0	0.0	0.0	3.8	0.4	0.0	6.2	5.6	0.0	1.0	17.5	11.3	3.3
			3.93	5.91	3.05	12.78	7.87	10	19	18	20	10 78	0	244		
218	346	3	237-1.00	2.0	0.0	0.0	3.8	0.4	0.0	6.2	5.6	0.0	0.7	17.5	11.3	3.3
			3.93	5.91	3.05	12.22	7.43	10	19	18	19	10 77	0	244		
218	346	4	237-1.00	2.0	0.0	0.0	3.8	0.4	0.0	6.2	5.6	0.0	0.7	17.5	11.3	3.3
			3.93	5.91	3.05	12.22	7.43	10	19	18	19	10 77	0	244		
218	347	1	237-1.00	0.0	7.3	20.1	3.8	0.3	0.0	6.4	5.5	0.0	0.8	17.7	11.4	24.9
			4.52	7.89	7.21	16.53	8.03	8	19	19	21	10 78	0	245		
218	347	2	237-1.00	1.8	0.3	0.0	4.0	1.2	0.0	6.4	5.5	0.0	0.5	17.7	11.4	3.3
			3.84	5.80	3.82	11.40	3.21	8	20	18	21	10 78	0	245		

TSOILMST AUGUST 24, 1975 EARTH SATELLITE CORP.

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	92.0													
337	87.1	94.0												
339	92.3	89.9	122.2	98.4										
341	96.2	100.9	112.3	107.1	67.8	76.0								
343	93.3	109.1	49.7	42.7	77.8	64.0	55.7	87.4						
345	82.5	30.4	31.7	21.0	31.1	55.1	81.7	10.6	102.4	96.9	88.8			
347		84.7	83.7	63.8	68.7	33.4	3.4	2.8	88.8	0.0	93.0	95.8	102.9	1.5
349			84.2	22.5	24.1	1.9	86.0	92.4	0.4	0.4	87.3	92.2	101.7	11.4
351					23.8	1.2	78.0	1.2	0.4	6.1	93.0	91.9	109.6	41.6
353					25.0	69.8	1.2	78.3	83.5	93.3	4.0	92.6	29.4	0.0
355					24.6	66.3	68.8	68.6	99.8	93.5	83.7	91.5	102.3	24.9
357						71.3	86.4	99.6	99.0	0.0	97.5	100.4	101.9	99.0
359								29.3	106.6	103.5	104.3	98.6	112.1	125.1
361										103.2	98.2		109.1	121.3

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	9.5													
337	7.2	9.5												
339	7.2	9.5	25.6	9.5										
341	7.2	9.5	9.5	9.5	9.5	9.5								
343	7.2	9.5	9.5	9.5	9.5	9.5	3.5	2.8						
345	0.0	2.1	2.1	2.1	9.5	9.5	3.5	2.8	6.3	1.5	1.5			
347		2.1	2.1	2.1	2.1	9.5	3.5	2.8	0.0	0.0	0.0	0.0	0.0	0.0
349			2.1	2.1	2.1	0.0	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0
351					0.0	1.2	0.0	1.2	0.0	0.0	0.0	0.0	7.0	0.0
353					1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0
355					0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	7.0	7.0
357						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
359								0.0	0.0	0.0	0.0	0.0	5.0	18.6
361										0.0	0.0		6.0	19.6

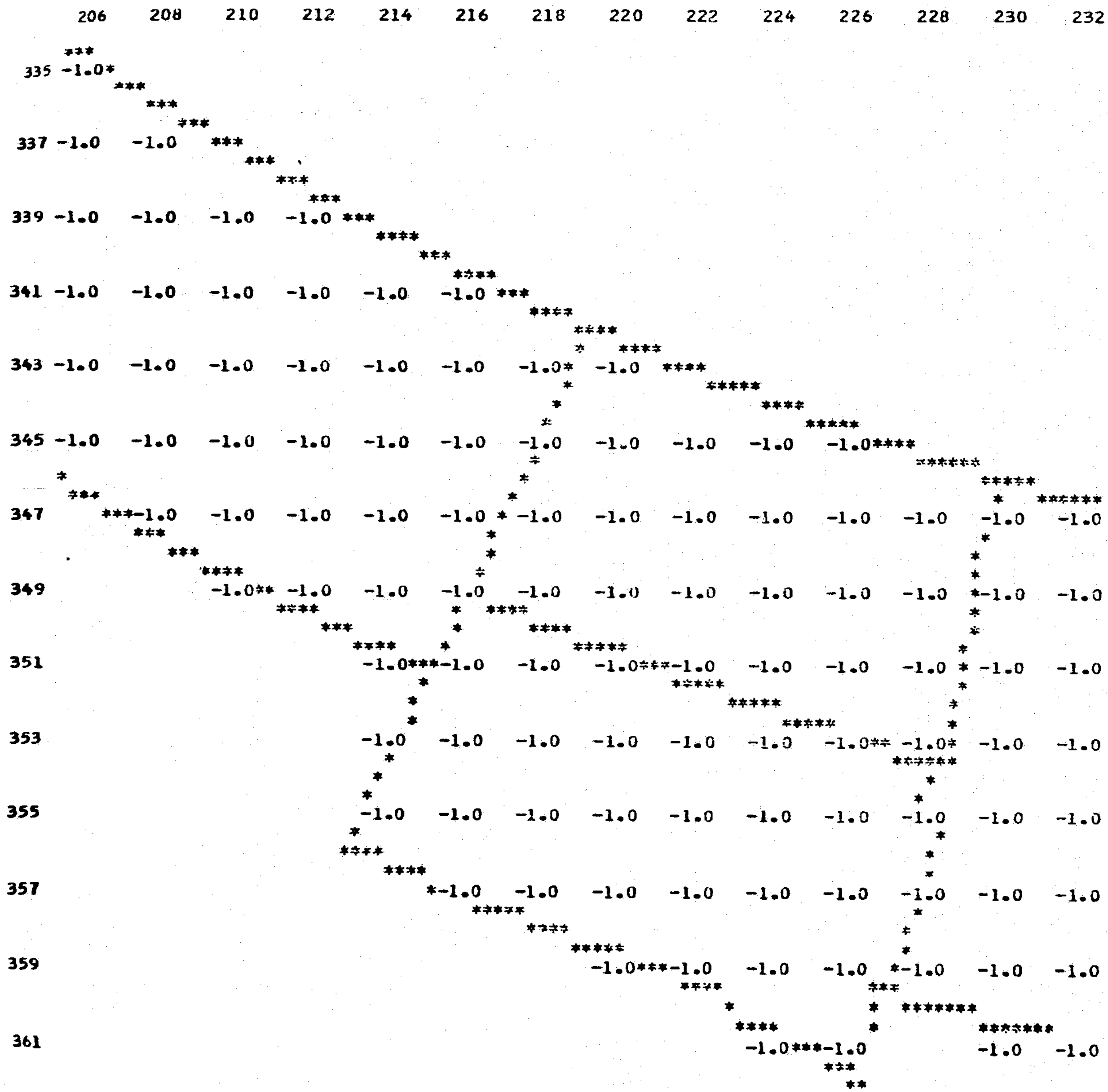
ETP AUGUST 24, 1975 EARTH SATELLITE CORP.

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	4.0													
337	5.0	4.1												
339	4.7	3.2	3.6	3.0										
341	4.7	4.0	3.2	2.7	2.0	1.5								
343	5.5	4.7	4.5	3.6	2.0	1.7	2.3	2.0						
345	9.8	7.3	6.8	6.0	3.1	1.7	2.5	3.0	2.7	4.8	6.6			
347		7.5	7.1	8.2	6.5	1.8	3.3	3.8	8.7	8.0	8.1	5.1	4.7	7.0
349			7.3	9.3	9.7	9.6	6.5	5.5	10.0	10.0	9.3	9.3	7.0	8.5
351					10.8	7.7	9.5	7.8	10.6	10.3	10.7	11.1	9.0	7.8
353					10.1	10.1	11.2	11.3	11.8	12.0	12.3	11.2	9.0	9.0
355					11.0	10.1	11.2	12.5	12.0	11.8	12.5	11.1	8.8	7.6
357						11.0	10.8	11.1	10.6	9.8	8.7	10.0	8.6	8.0
359								10.3	6.8	7.1	6.7	8.2	7.7	5.8
361										5.8	8.5		7.0	5.1

ETP-ET AUGUST 24, 1975 EARTH SATELLITE CORP.

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	2.7													
337	3.5	2.8												
339	1.7	1.2	0.7	2.3										
341	3.2	1.3	1.0	0.9	1.4	1.1								
343	3.6	3.0	2.7	1.1	1.4	1.2	2.0	1.7						
345	9.2	6.8	5.8	5.3	2.7	1.4	2.1	0.4	1.8	3.9	2.3			
347		6.8	5.8	6.5	5.3	1.6	2.6	2.5	5.8	7.1	7.3	1.9	1.8	1.5
349			7.0	7.9	8.2	7.7	4.8	4.9	2.6	2.6	3.0	2.9	2.4	1.8
351					10.1	7.7	8.4	7.0	3.3	3.5	3.2	3.2	2.6	1.3
353					.2	9.6	9.5	10.5	3.1	3.3	5.5	10.6	9.0	9.0
355					10.3	9.5	10.4	11.9	10.7	10.2	10.4	10.2	7.6	1.4
357						9.6	9.0	9.8	9.1	9.8	6.2	8.1	7.3	2.7
359								8.0	5.5	5.8	4.3	7.3	5.6	4.8
361										3.9	7.1		5.9	4.3

BMT AUGUST 24, 1975 EARTH SATELLITE CORP.



RNET AUGUST 24, 1975 EARTH SATELLITE CORP.

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	114													
337	236	114												
339	236	79	113	113										
341	191	107	115	114	108	112								
343	189	109	116	112	110	113	160	162						
345	518	234	234	233	112	112	159	170	130	290	390			
347		236	236	409	407	113	159	171	471	445	434	254	251	408
349			236	412	412	498	247	224	458	447	429	422	268	431
351					511	238	441	198	460	439	430	441	378	435
353					424	421	446	444	442	436	447	445	382	438
355					473	411	467	461	454	451	451	447	384	385
357						475	471	464	420	277	266	447	437	395
359								463	276	266	265	445	396	229
361										242	440		371	199

MAX TEMP AUGUST 24, 1975

EARTH SATELLITE CORP.

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	16.8													
337	16.5	17.5												
339	15.7	16.5	17.6	15.0										
341	15.8	16.5	15.8	14.5	13.5	12.5								
343	16.7	17.0	16.5	15.5	13.8	14.7	16.0	16.6						
345	17.6	18.0	17.5	16.5	15.1	15.3	16.1	18.0	18.8	24.2	26.7			
347		18.1	17.8	17.3	16.2	15.5	19.0	19.7	24.0	25.6	28.6	27.0	26.2	29.6
349			19.7	20.5	21.5	22.8	22.7	21.5	24.7	28.3	29.1	31.3	31.8	32.3
351					22.5	24.5	23.8	27.6	27.8	29.2	32.0	32.0	32.5	33.1
353					25.0	25.6	28.1	28.5	32.1	33.3	34.5	33.0	32.3	32.5
355					25.6	28.0	30.1	33.0	34.6	35.0	35.0	32.7	31.6	31.7
357						29.8	30.2	31.8	34.3	36.8	35.1	33.7	31.3	31.3
359								33.5	31.8	33.0	32.7	32.0	31.2	31.2
361										31.6	32.3		31.6	31.1

MIN TEMP AUGUST 24, 1975 EARTH SATELLITE CORP.

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	9.0													
337	8.5	10.6												
339	7.7	9.2	11.0	10.3										
341	7.7	8.5	9.7	10.3	10.3	10.0								
343	8.5	8.8	10.2	10.3	10.7	11.1	11.5	11.8						
345	9.1	9.3	10.1	10.3	10.5	11.3	11.5	12.0	12.1	15.5	16.7			
347		9.6	10.2	10.5	11.2	11.5	12.0	12.1	13.8	15.0	17.2	16.8	16.5	16.2
349			11.5	11.8	12.3	13.5	13.2	12.3	13.1	16.3	17.7	19.5	19.3	17.8
351					13.0	14.0	13.7	15.7	15.6	17.1	21.0	21.1	20.1	17.7
353					14.3	15.0	16.5	16.7	18.7	20.2	22.0	21.2	20.0	19.3
355					14.6	16.5	18.6	19.7	21.8	21.8	21.8	21.3	20.8	19.7
357						17.5	18.0	20.3	21.8	21.2	22.2	21.6	21.0	20.7
359								20.6	22.5	22.5	23.2	23.1	21.3	21.3
361										23.2	23.2		22.7	21.5

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5.3 YIELD Prediction

5.3.1 PREDRUN

5.3.1.1 Functional Description

The yield model represents the integration of each of the data elements, basic and derived from each of the other functional elements. The yield element provides data which represents an end of year yield estimate aggregated at several levels:

(1) Cells

(2) Countries

(3) Crop Reporting Districts

(4) States

5.3.1.2 Mathematical Description

The yield, Y, in bushels per acre was given by:

$$Y = -10.0556 + 0.56386\ .YR - 31.2954\ .\ (\overline{S})^2$$

where $\overline{S}$ is the average daily plant stress from planting to ripe and YR is the year (=75).

The above equation was used to predict yields for each of the 12.5 mile cells. County yields were calculated using the straight numerical average of the N cells assigned to the county:

$$Y_{co} = \frac{1}{N} \sum_{i=1}^{n} Y_i \quad .$$

Yields at the crop reporting district level and state level were formed by weighted aggregations of the next smaller reporting unit:

$$Y_{crd} = \sum_{i=1}^{N_{co}} Y_{coi} \cdot R_{(co/crd)\ i}$$

$$Y_{st} = \sum_{i=1}^{N_{crd}} Y_{crd_i} \cdot R_{(crd/st)_i}$$

where the R's represent the fraction of planted wheat acreage in the larger aggregate contained in each element of the smaller aggregate. These fractions represent the average of all available data beginning in 1970. (Note that the R's are defined such that

$$\sum_{i=1}^{N} R_i = 1.0.)$$

5.3.1.3 PREDRUN EXECUTION

Job Control Language

```
//PREDRUN JOB  (BR9001,746),ANDERSON,CLASS=F
//        EXEC FORTGCLG,PARM.FORT='MAP,ID',REGION.GO=66K
//*
//*            MODULE PREDRUN
//*
//FORT.SYSIN DD *
                       -  Fortran Source Deck  -

//LKED.SYSLIB DD
//             DD DSN=EARTHSAT.LOADLIB,DISP=SHR

//GO.FT05F001 DD DDNAME=SYSIN
//FT06F001     DD SYSOUT=A
//FT10F001     DD SYSOUT=C,DCB=(RECFM+FBA,LRECL=133,BLKSIZE=1330)
//FT29F001     DD DSN=ARCH2,DISP=(OLD,DELETE)
//HISTORIC     DD DSN=HIST.G1,DISP=(OLD,KEEP,KEEP),
// UNIT=2314,VOL=SER=IPIWRK
//SYSUDUMP     DD SYSOUT=A
//SYSIN DD *

                       -  FT05F001 Data Deck  -

/*
//
```

Data Definition Description

GO STEP

FT05F001: Map overlay, state, county vectors.

FT06F001: Map I, J output.

FT10F001: Aggregate listings.

FT29F001: Last day status from AGRUN.

HISTORIC: Historical region specific characteristics.

5.3.1.4 DATA DESCRIPTION

FT05F001 DATA CARDS

1. SEQUENCE

MAP OVERLAY DATA	102 CARDS	MAP OVERLAY CARDS
COUNTY YIELD WEIGHT COEFFICIENTS	15 CARDS	COUNTY YIELD WEIGHT CARD
CROP REPORTING DISTRICT WEIGHT COEFFICIENTS	4 CARDS	CROP REPORTING YIELD WEIGHT CARD
STATE NAMES CARD	1 CARD	STATE NAME CARD
COUNTY NAMES CARD	64 CARDS	COUNTY NAME CARD
CROP REPORTING DISTRICT NAMES	8 CARDS	REPORTING DISTRICT CARDS

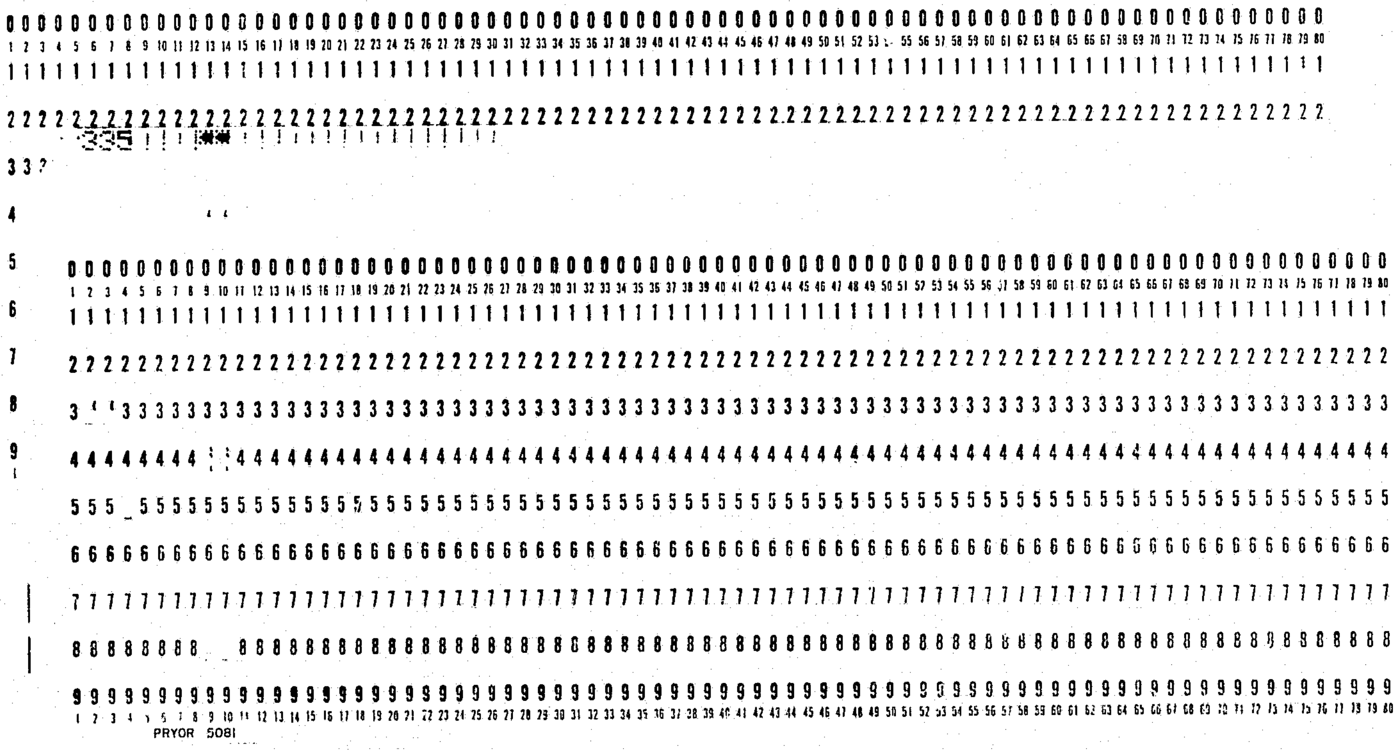
MAP OVERLAY - DATA CARD

FORMAT: (80A1/20A1)

Note: Format requires two cards per line

Variable	Format	Cols	Description
OVLY (I,J)	80 A1	1-80	Output line masked with area boundaries
.			
.			
.	Card #2		
OVLY (I+80,J)	20 A1	1-20	Output line continued
.			

SAMPLE CARD:



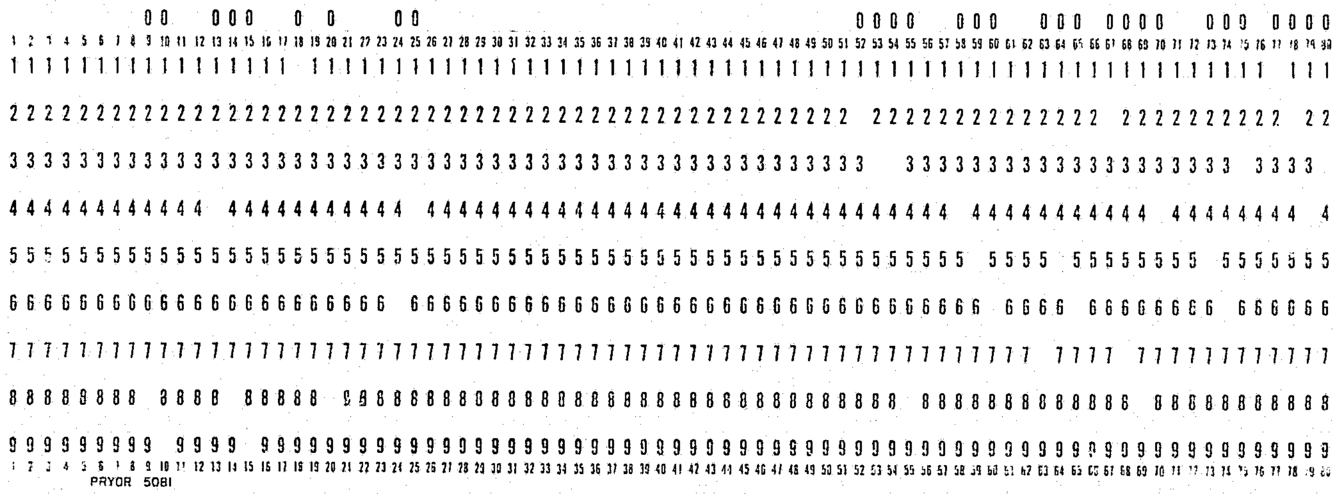
COUNTY WEIGHT DATA CARD

FORMAT: (16F5.4)

COFR (1,I)	F5.4	County weight coefficients for county #I in state #J
.		
.		
.		
COFR (I,J)	F5.4	(16 per card)
		Blank when no county

SAMPLE CARD:

00000000890048900108000840000000000000000000000000000023380045600756027840056301243



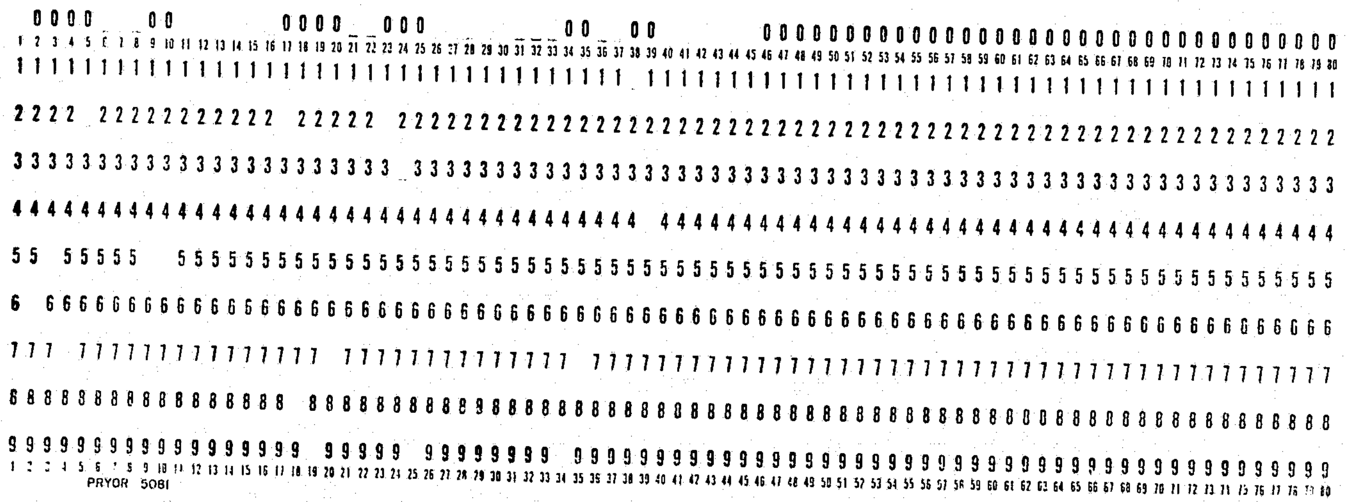
CROP REPORTING DISTRICT WEIGHT DATA CARD

FORMAT: (9F5.4)

Variable	Format	Cols	Description
RDFR(1,1)	F5.4	1-5	Crop Reporting District Weights for Reporting District I in State J
.			
.			
.			
RDFR(I,J)	F5.4	1-45	

SAMPLE CARD:

065720005500000028970023900000000970014000000

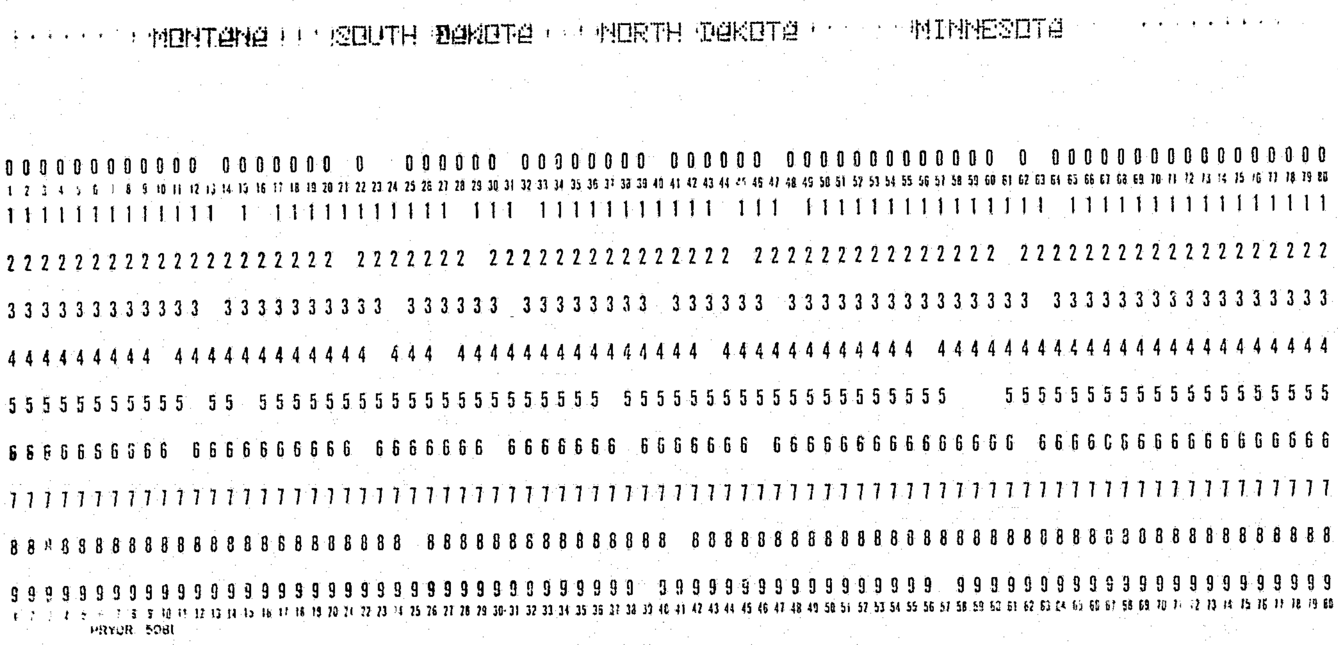


STATE NAMES DATA CARD

FORMAT: (10A8)

Variable	Format	Cols	Description
STNAME(1,1)	A8	1-8	
STNAME(2,1)	A8	9-16	
.			
.			
.			
STNAME(1,N)	8A8	17-80	First half nth state name
STNAME(2,N)			Second half nth state name

SAMPLE CARD:

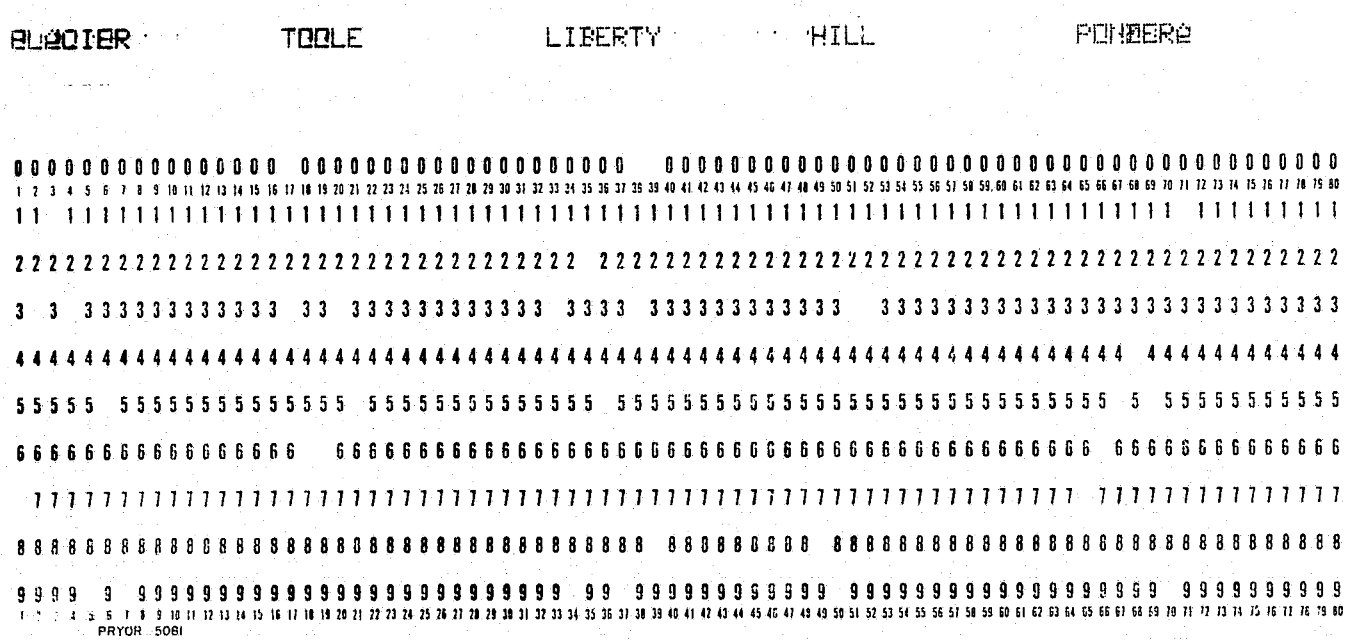


COUNTY NAMES DATA CARD

FORMAT: (10A8)

Variable	Format	Cols	Description
CONAME(1,1,1)	A8	1-8	
CONAME(2,1,1)	A8	9-16	
.			
.			
.			
CONAME(1,I,J)	8A8		1st half county name for county I State J
CONAME(1,I,J)		17-64	2nd half county name for County I State J

SAMPLE CARD:



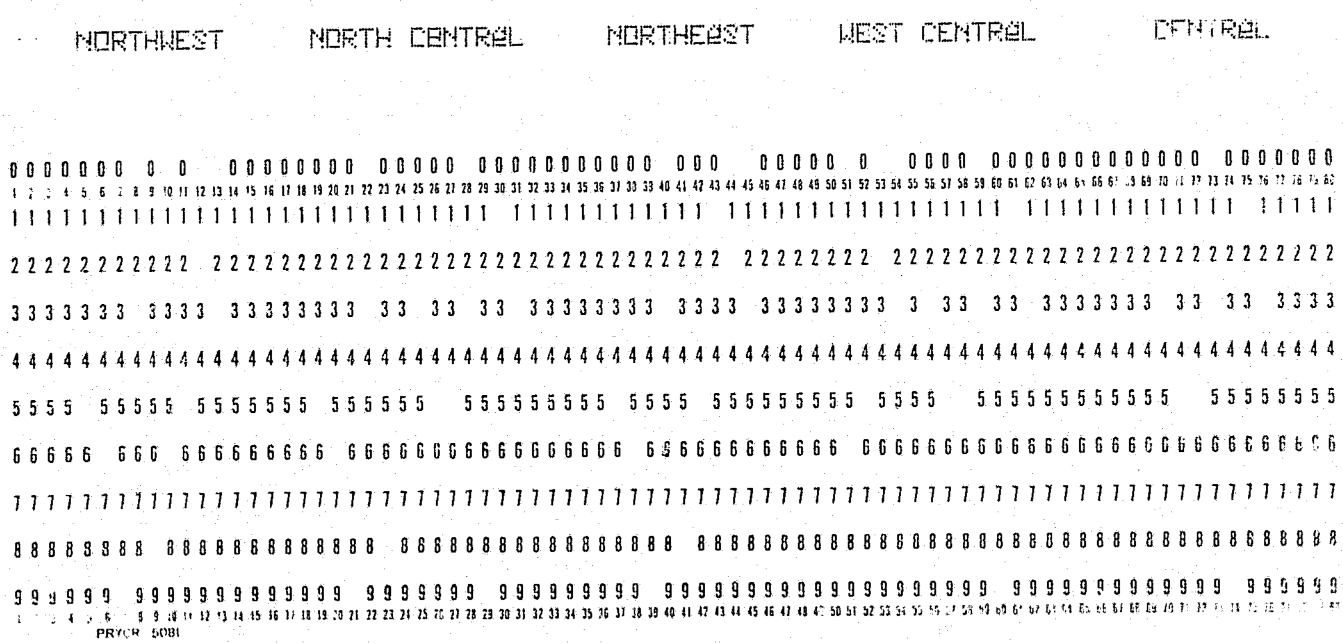
CROP REPORTING DISTRICT DATA CARD

FORMAT: (10A8/8A8)

Note: two cards per use of Format Statement

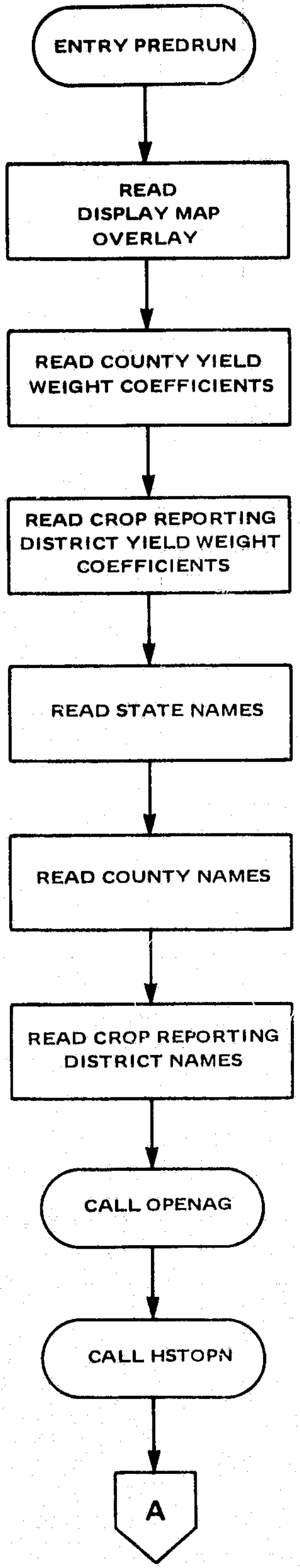
Variable	Format	Cols	Descrition
RDNAME(1,1,1)	A8	1-8	
RDNAME(2,1,1)	A8	9-16	
	A8	17-80 Card 2	1st half county name for Reporting District I
.			
.			
.			
RDNAME(1,I,J)	A8	1-64	State J 2nd half of name for reporting district I State J
RDNAME(2,I,J)	A8		

SAMPLE CARD:

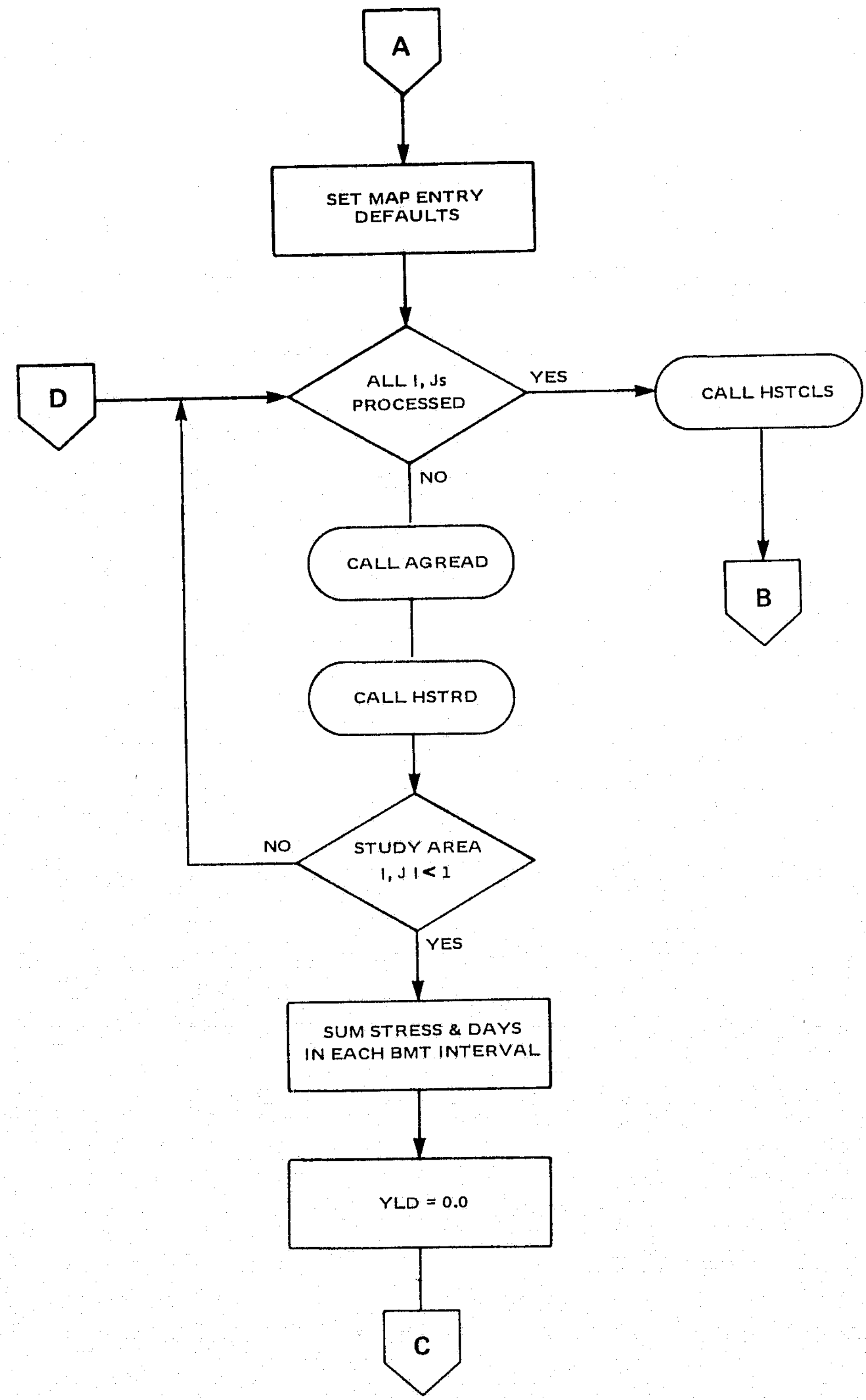


5.3.1.5 FLOWCHART

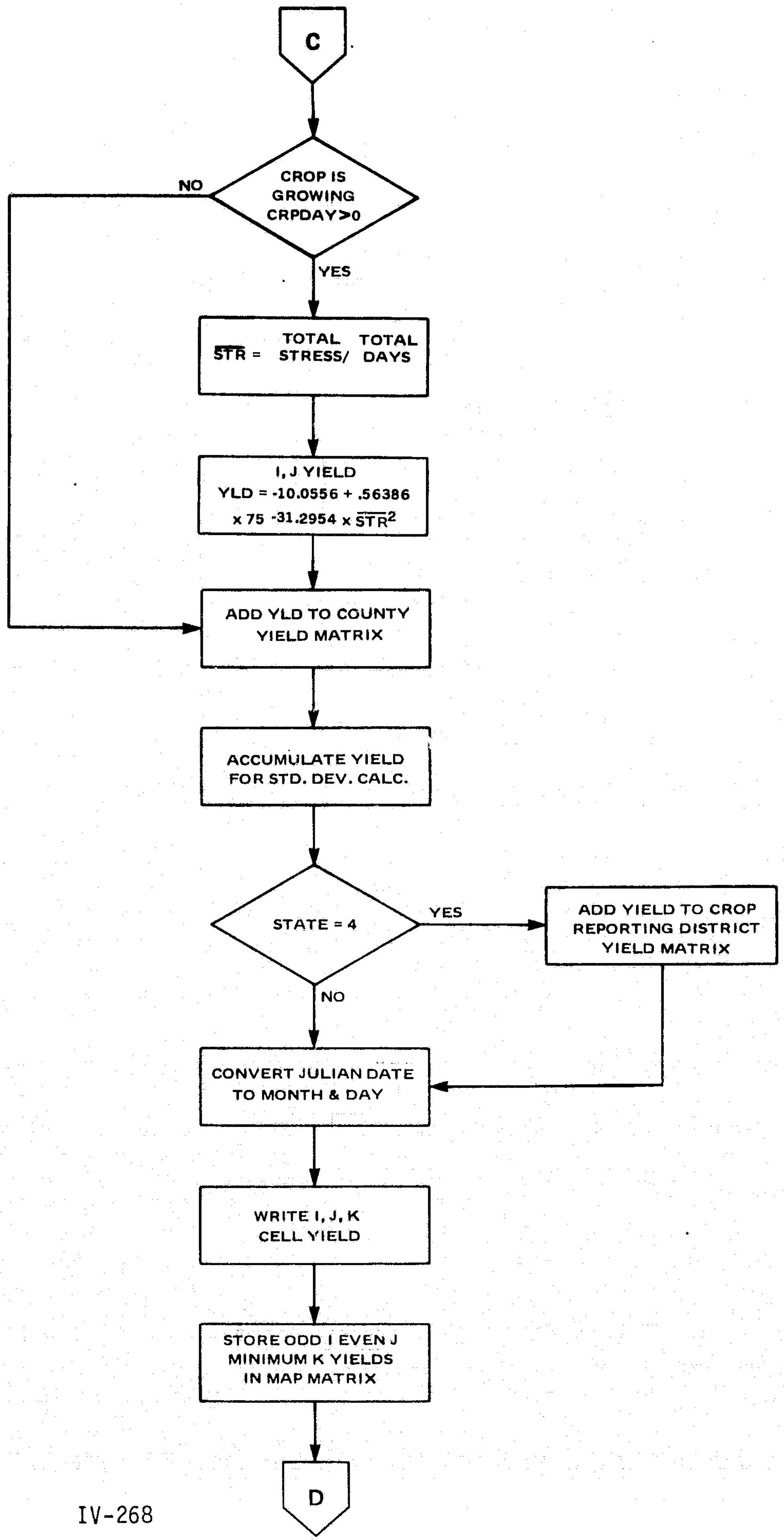
PREDRUN



PREDRUN

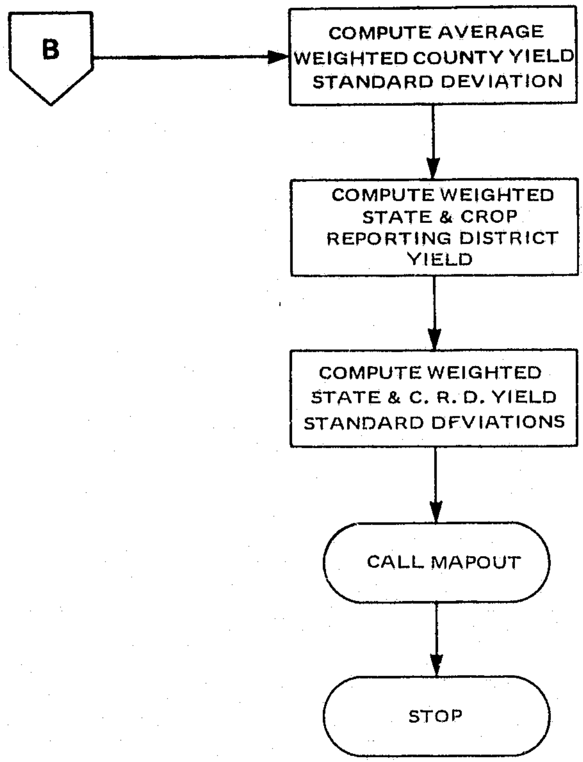

A
SET MAP ENTRY DEFAULTS
D
ALL I, Js PROCESSED
YES
CALL HSTCLS
B
NO
CALL AGREAD
CALL HSTRD
NO
STUDY AREA I, J I < 1
YES
SUM STRESS & DAYS IN EACH BMT INTERVAL
YLD = 0.0
C

PREDRUN

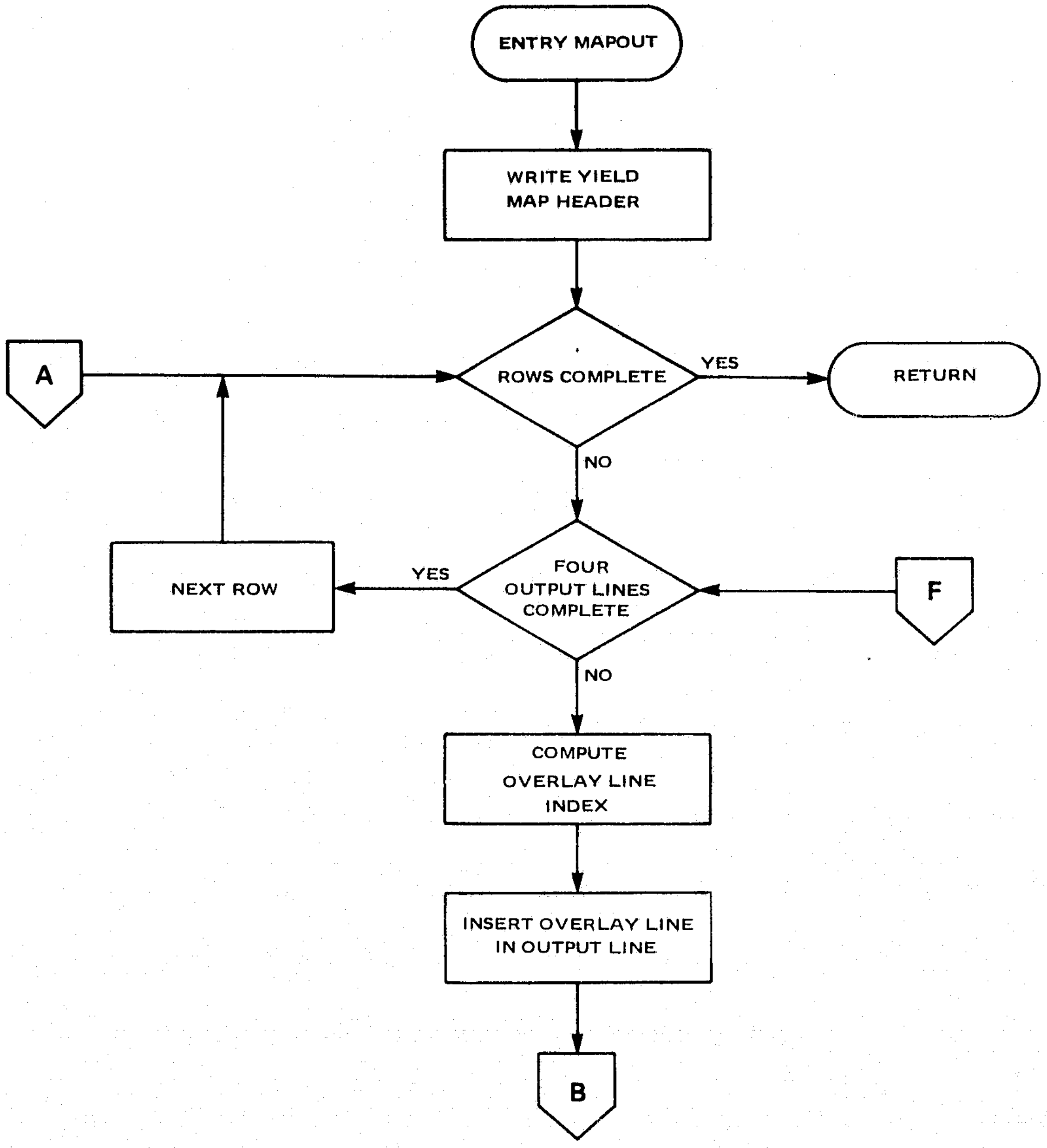


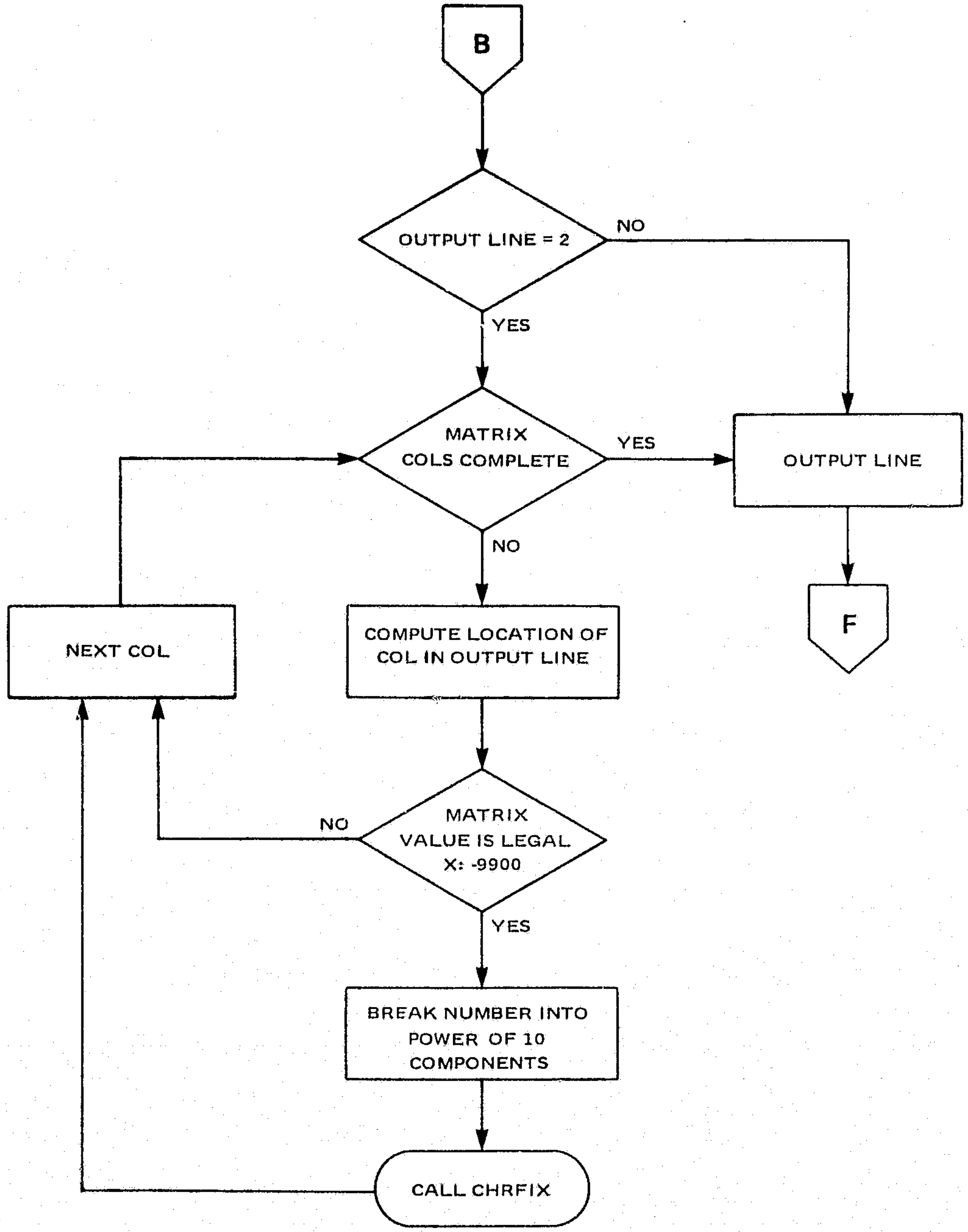
C
CROP IS GROWING CRPDAY>0
NO
YES
STR = TOTAL STRESS/ TOTAL DAYS
I, J YIELD YLD = -10.0556 + .56386 x 75 -31.2954 x STR2
ADD YLD TO COUNTY YIELD MATRIX
ACCUMULATE YIELD FOR STD. DEV. CALC.
STATE = 4
YES
NO
ADD YIELD TO CROP REPORTING DISTRICT YIELD MATRIX
CONVERT JULIAN DATE TO MONTH & DAY
WRITE I, J, K CELL YIELD
STORE ODD I EVEN J MINIMUM K YIELDS IN MAP MATRIX
D

PREDRUN

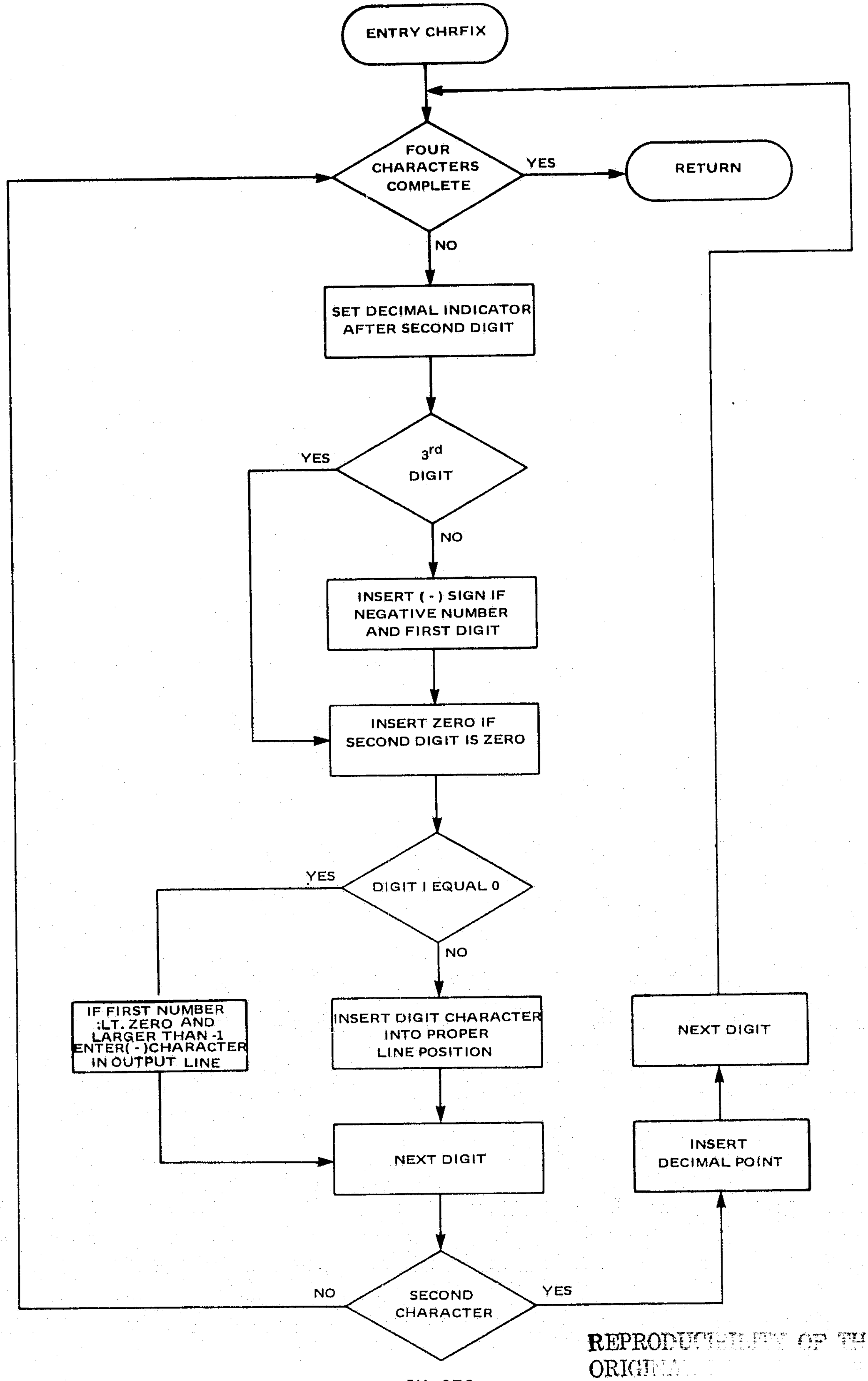

B
COMPUTE AVERAGE WEIGHTED COUNTY YIELD STANDARD DEVIATION
COMPUTE WEIGHTED STATE & CROP REPORTING DISTRICT YIELD
COMPUTE WEIGHTED STATE & C. R. D. YIELD STANDARD DFVIATIONS
CALL MAPOUT
STOP

SUBROUTINE MAPOUT




B
OUTPUT LINE = 2
NO
YES
MATRIX
COLS COMPLETE
YES
OUTPUT LINE
NO
F
NEXT COL
COMPUTE LOCATION OF
COL IN OUTPUT LINE
NO
MATRIX
VALUE IS LEGAL
X: -9900
YES
BREAK NUMBER INTO
POWER OF 10
COMPONENTS
CALL CHRFIX

SUBROUTINE CHRFIX



5.3.1.6 SOURCE CODE

```
      REAL*8 AMON(6)/'    APRIL','     MAY','    JUNE','    JULY',       0(
     *  '  AUGUST','   SEPT.'/                                            0(
      REAL*8 STNAME(2,4),CONAME(2,80,4),RDNAME(2,9,4),BLANK/'        '/
      REAL SM(3),ET(3),STRINT(5),COFR(80,3),RDFR(9,4),LAT,LON
      REAL YLDCO(80,4)/320*0./,YLDRD(9,4)/36*0./
      REAL SUMY(10,4)/40*0./,SUMYY(10,4)/40*0./,NCLCRD(10,4)/40*0./
      INTEGER NDAYS(6)/90,120,151,181,212,243/
      INTEGER JCO(10,3)/ 0,10,19,27,37,42,49,56,0,0,0,6,14,22,28,37,47,
     $  52,58,67,0,6,11,18,23,29,34,41,46,53/
      INTEGER NUMCO(80,4)/320*0/,NUMRD4(9)/9*0/
      INTEGER*2 OVLY(101,56),NDAY(5),CRPDAY,TSOIL,RAD,ICDAY
      INTEGER*2 IMAP(14,14),STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,
     $  TMAX,TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,CRD,SOIL,
     $  PLNDAT,TSTSIT
      COMMON/MAP/OVLY
      IPJ=0
      NL=1
      JULD=-999
      READ(5,1000) OVLY
 1000 FORMAT(80A1/21A1)
      READ(5,1001) COFR
 1001 FORMAT(16F5.4)
      READ(5,1002) RDFR
 1002 FORMAT(9F5.4)
      READ(5,1003) STNAME
      READ(5,1003) CONAME
      READ(5,1004) RDNAME
 1003 FORMAT(10A8)
 1004 FORMAT(10A8/8A8)
      CALL OPENAG
      CALL HSTOPN(II)
      DO 10 L=1,14
      DO 10 M=1,14
      IMAP(L,M)=-9999
 10   CONTINUE
      DO 90 IJK=1,3024
      CALL AGREAD(I)
      CALL HSTRD(IJK)
      IF(I.LT.1) GO TO 90
      AVST=0.
      ICDAY=0
      DO 20 IS=1,5
      AVST=AVST+STRINT(IS)
      ICDAY=ICDAY+NDAY(IS)
 20   CONTINUE
      YLD=0.
      IF(CRPDAY) 30,30,25
   25 AVST=AVST/ICDAY
      YLD=-10.0556+0.56386*75.-31.2954*AVST**2
      IF(YLD.LT.0.) YLD=0.
```

```
30    YLDCO(COUNTY,STATE)=YLDCO(COUNTY,STATE)+YLD
      NUMCO(COUNTY,STATE)=NUMCO(COUNTY,STATE)+1
      SUMY(CRD,STATE)=SUMY(CRD,STATE)+YLD
      SUMY( 10,STATE)=SUMY( 10,STATE)+YLD
      SUMYY(CRD,STATE)=SUMYY(CRD,STATE)+YLD*YLD
      SUMYY( 10,STATE)=SUMYY( 10,STATE)+YLD*YLD
      IF(YLD.NE.0.) NCLCRD(CRD,STATE)=NCLCRD(CRD,STATE)+1.
      IF(YLD.NE.0.) NCLCRD( 10,STATE)=NCLCRD( 10,STATE)+1.
      IF(STATE.NE.4) GO TO 40
      YLDRD(CRD,4)=YLDRD(CRD,4)+YLD
      NUMRD4(CRD)=NUMRD4(CRD)+1
40    CONTINUE
      IF(JUL.EQ.JULD) GO TO 70
      JULD=JUL
      DO 50 IM=1,6
      MDAY=JULD-NDAYS(IM)
      IF(MDAY) 60,60,50
50    CONTINUE
      IM=IM+1
60    CONTINUE
      IM=IM-1
      MDAY=JULD-NDAYS(IM)
70    IF(NL.EQ.1) WRITE(10,1070) AMON(IM),MDAY
1070 FORMAT(1H1,52X,'EARTH SATELLITE CORP.'/50X,'ESTIMATED CELL YIELD (
     $BU/A)'/48X,'PROJECTED FROM',A8,I3,', 1975'//32X,'I     J    K     YIE
     $LD',13X,'STATE  CROP REP. DIST.    COUNTY'/)
      WRITE(10,1071) I,J,K,YLD,(STNAME(M,STATE),M=1,2),
     $ (RDNAME(M,CRD,STATE),M=1,2),(CONAME(M,COUNTY,STATE),M=1,2)
1071 FORMAT(29X,2I5,I3,4X,F5.2,3(2X,2A8))
      NL=NL+1
      IF(NL.GE.51) NL=1
      IF(I+J.EQ.IJP) GO TO 80
      L=MOD(I,2)
      IF(L.EQ.1) GO TO 90
      L=MOD(J,2)
      IF(L.NE.1) GO TO 90
      I1=I-205
      J1=J-334
      I1=((I1-1)/2)+1
      J1=((J1-1)/2)+1
      IMAP(I1,J1)=YLD*100.
      IJP=I+J
80    CONTINUE
90    CONTINUE
      CALL HSTCLS
      DO 100 IS=1,4
      NL=1
      DO 100 IC=1,80
      IF(CONAME(1,IC,IS).EQ.BLANK) GO TO 100
      COYLD=YLDCO(IC,IS)/NUMCO(IC,IS)
      YLDCO(IC,IS)=COYLD
```

```
      IF(NL.EQ.1) WRITE(10,1090) AMON(IM),MDAY,(STNAME(M,IS),M=1,2)
 1090 FORMAT(1H1,56X,'EARTH SATELLITE CORP.'/53X,'ESTIMATED COUNTY YIELD
     * (BU/A)'/52X,'PROJECTED FROM',A8,I3,', 1975'//51X,2A8,' COUNTIES'
     *//57X,'COUNTY',11X,'YIELD'/)
      WRITE(10,1091) (CONAME(M,IC,IS),M=1,2),COYLD
 1091 FORMAT(57X,2A8,F6.2)
      NL=NL+1
      IF(NL.GE.51) NL=1
 100  CONTINUE
      WRITE(10,1100) AMON(IM),MDAY
 1100 FORMAT(1H1,60X,'EARTH SATELLITE CORP.'/61X,'ESTIMATED YIELD (BU/A)
     $'/55X,'STATES & CROP REPORTING DISTRICTS'/56X,'PROJECTED FROM',A8,
     *I3,', 1975'//51X,'STATE     CROP REP. DIST.     YIELD     STD. DEV.')
      DO 110 IS=1,3
      IDF=9
      IF(IS.EQ.1) IDF=7
      DO 110 ID=1,IDF
      IC1=JCO(ID,IS)+1
      IC2=JCO(ID+1,IS)
      DO 110 IC=IC1,IC2
      IF(CONAME(1,IC,IS).EQ.BLANK) GO TO 110
      YLDRD(ID,IS)=YLDRD(ID,IS)+YLDCO(IC,IS)*COFR(IC,IS)
 110  CONTINUE
      DO 120 ID=1,9
      IF(RDNAME(1,ID,4).EQ.BLANK) GO TO 120
      YLDRD(ID,4)=YLDRD(ID,4)/NUMRD4(ID)
 120  CONTINUE
      DO 140 IS=1,4
      STYLD=0.
      IDF=9
      IF(IS.EQ.1) IDF=7
      DO 130 ID=1,IDF
      STYLD=STYLD+YLDRD(ID,IS)*RDFR(ID,IS)
 130  CONTINUE
      SDSTYL=(NCLCRD(10,IS)*SUMYY(10,IS)-SUMY(10,IS)**2)/NCLCRD(10,IS)
     * **2
      SDSTYL=SQRT(SDSTYL)
      WRITE(10,1130) (STNAME(M,IS),M=1,2),STYLD,SDSTYL
 1130 FORMAT(1H0/40X,2A8,22X,F6.2,5X,F6.3/)
      DO 140 ID=1,IDF
      IF(RDNAME(1,ID,IS).EQ.BLANK) GO TO 140
     * **2
      SDRDYL=SQRT(SDRDYL)
      WRITE(10,1131) (RDNAME(M,ID,IS),M=1,2),YLDRD(ID,IS),SDRDYL
 1131 FORMAT(59X,2A8,3X,F6.2,5X,F6.3)
 140  CONTINUE
      CALL MAPOUT(AMON(IM),MDAY,IMAP)
      STOP
      END
```

```
      SUBROUTINE MAPOUT(AMON,MDAY,IVAL)
      REAL*8 AMON
      INTEGER*2 OVLY(101,56),IVAL(14,14),LINE(101),LVAL(5),JVAL
      COMMON /MAP/ OVLY
      WRITE(10,1000) AMON,MDAY
 1000 FORMAT(1H1,54X,'EARTH SATELLITE CORP.'/52X,'ESTIMATED CELL YIELD (
     *BU/A)'/50X,'PROJECTED FROM',A8,I3,', 1975'//'       206     208     2
     $10     212     214     216     218     220     222     224     226     228
     $     230     232'/)
      DO 80 I=1,14
      DO 80 J=1, 4
      L=(I-1)*4+J
      DO 30 K=1,101
   30 LINE(K)=OVLY(K,L)
      GO TO (70,40,70,70),J
   40 DO 60 K=1,14
      KC1=(K-1)*7+6
      JVAL=IVAL(K,I)
      IF(JVAL.LT.-9900) GO TO 60
      DO 50 KK=1,3
      LVAL(KK)=JVAL/10**(4-KK)
   50 JVAL=JVAL-LVAL(KK)*10**(4-KK)
      LVAL(4)=JVAL
      CALL CHRFIX(KC1,LINE,LVAL)
   60 CONTINUE
   70 WRITE(10,2000) LINE
 2000 FORMAT(101A1)
   80 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CHRFIX(K1,LINE,L)
      INTEGER*2 LINE(101),L(5),NUM(10)/'0','1','2','3','4','5','6','7',
     *   '8','9'/,IMIN/'-'/,IDEC/'.'/
      LN=0
      LM=0
      IC=K1
      DO 40 I=1,4
      IF(I.EQ.2) LN=1
      IF(I.GE.3) GO TO 10
      IF(LN.EQ.0.AND.L(I+1).LT.0) LINE(IC)=IMIN
   10 IF(L(I).EQ.0.AND.LN.NE.0) LINE(IC)=NUM(1)
      IF(L(I).LT.0) LM=1
      IF(L(I).EQ.0) GO TO 20
      LN=1
      LL=L(I)
      LINE(IC)=NUM(IABS(LL   )+1)
      GO TO 30
20    IF(LN.EQ.0.AND.I.EQ.1.AND.L(2).EQ.0.AND.L(4).LT.0) LINE(IC)=IMIN
   30 IC=IC+1
      IF(I.NE.2) GO TO 40
      LINE(IC)=IDEC
      IC=IC+1
   40 CONTINUE
   50 RETURN
      END
```

5.3.1.7 PREDRUN SAMPLE OUTPUT

EARTH SATELLITE CORP.
ESTIMATED CELL YIELD (BU/A)
PROJECTED FROM AUGUST 30, 1975

	206	208	210	212	214	216	218	220	222	224	226	228	230	232
335	23.19													
337	22.92	23.84												
339	24.08	23.82	21.24	23.49										
341	25.73	24.24	24.36	24.78	21.37	22.44								
343	25.48	26.26	24.83	22.89	22.41	22.13	22.23	25.02						
345	25.70	23.88	23.26	21.99	22.54	22.50	25.10	26.62	24.12	28.15	28.22			
347		26.08	23.00	20.81	21.48	22.29	21.93	24.93	23.66	25.76	26.34	26.55	30.03	28.83
349			24.06	22.42	23.01	21.35	25.16	29.19	25.67	27.38	28.01	27.40	29.97	29.23
351					24.05	24.87	22.67	24.36	26.57	28.90	28.37	28.11	28.34	29.31
353					23.65	23.36	23.00	23.83	25.90	26.98	27.01	27.84	30.12	29.03
355					22.45	23.34	23.61	24.26	25.96	26.52	25.16	28.95	29.98	29.57
357						24.38	24.53	25.15	25.35	24.10	26.47	27.24	28.43	28.36
359								28.16	25.66	25.72	26.04	28.17	28.45	28.69
361										25.52	25.07		28.22	28.33

EARTH SATELLITE CORP.
ESTIMATED COUNTY YIELD (BU/A)
PROJECTED FROM AUGUST 30, 1975

NORTH DAKOTA COUNTIES

COUNTY	YIELD
DIVIDE	25.21
BURKE	23.43
RENVILLE	24.96
WILLIAMS	23.80
MOUNTRAIL	25.14
WARD	24.64
BOTTINEAU	27.60
ROLETTE	27.23
MC HENRY	27.37
PIERCE	27.19
BENSON	25.65
TOWNER	27.47
CAVALIER	27.86
PEMBINA	27.21
RAMSEY	27.22
WALSH	26.75
NELSON	27.83
GRAND FORKS	26.96
MC KENZIE	25.78
DUNN	26.11
MC LEAN	24.04
MERCER	25.39
OLIVER	25.77
SHERIDAN	26.58
WELLS	26.27
EDDY	26.77
FOSTER	26.32
KIDDER	27.07
STUTSMAN	27.13
GRIGGS	27.96
STEELE	27.45
TRAILL	27.61
BARNES	28.17
CASS	28.24
GOLDEN VALLEY	25.64
BILLINGS	24.97
STARK	25.24
SLOPE	25.72
HETTINGER	25.57
BOWMAN	24.52
ADAMS	25.27
MORTON	27.03
BURLEIGH	25.58
GRANT	27.67
SIOUX	25.98
EMMONS	27.14
LOGAN	28.25
LA MOURE	28.07
RANSOM	28.53
MC INTOSH	27.49

EARTH SATELLITE CORP.
ESTIMATED CELL YIELD (BU/A)
PROJECTED FROM AUGUST 30, 1975

I	J	K	YIELD	STATE	CROP REP. DIST.	COUNTY
222	359	4	25.66	SOUTH DAKOTA	SOUTHEAST	CHARLES MIX
223	344	1	26.94	NORTH DAKOTA	NORTH CENTRAL	BOTTINEAU
223	344	2	26.94	NORTH DAKOTA	NORTH CENTRAL	BOTTINEAU
223	345	1	28.09	NORTH DAKOTA	NORTH CENTRAL	MC HENRY
223	345	2	25.74	NORTH DAKOTA	NORTHWEST	RENVILLE
223	345	3	26.12	NORTH DAKOTA	NORTH CENTRAL	BOTTINEAU
223	345	4	28.28	NORTH DAKOTA	NORTH CENTRAL	BOTTINEAU
223	346	1.	26.25	NORTH DAKOTA	NORTH CENTRAL	MC HENRY
223	346	2	26.26	NORTH DAKOTA	NORTH CENTRAL	MC HENRY
223	346	3	25.81	NORTH DAKOTA	NORTHWEST	WARD
223	346	4	28.26	NORTH DAKOTA	NORTH CENTRAL	MC HENRY
223	347	1	26.06	NORTH DAKOTA	CENTRAL	SHERIDAN
223	347	2	24.92	NORTH DAKOTA	WEST CENTRAL	MC LEAN
223	347	3	25.99	NORTH DAKOTA	NORTH CENTRAL	MC HENRY
223	347	4	25.95	NORTH DAKOTA	NORTH CENTRAL	MC HENRY
223	348	1	27.62	NORTH DAKOTA	CENTRAL	SHERIDAN
223	348	2	26.25	NORTH DAKOTA	SOUTH CENTRAL	BURLEIGH
223	348	3	27.78	NORTH DAKOTA	CENTRAL	SHERIDAN
223	348	4	25.98	NORTH DAKOTA	CENTRAL	SHERIDAN
223	349	1	24.58	NORTH DAKOTA	SOUTH CENTRAL	BURLEIGH
223	349	2	24.58	NORTH DAKOTA	SOUTH CENTRAL	BURLEIGH
223	349	3	24.58	NORTH DAKOTA	SOUTH CENTRAL	BURLEIGH
223	349	4	24.69	NORTH DAKOTA	SOUTH CENTRAL	BURLEIGH
223	350	1	25.79	NORTH DAKOTA	SOUTHEAST	LOGAN
223	350	2	26.04	NORTH DAKOTA	SOUTH CENTRAL	EMMONS
223	350	3	26.04	NORTH DAKOTA	SOUTH CENTRAL	BURLEIGH
223	350	4	25.54	NORTH DAKOTA	CENTRAL	KIDDER
223	351	1	26.59	NORTH DAKOTA	SOUTHEAST	MC INTOSH
223	351	2	25.54	NORTH DAKOTA	SOUTH CENTRAL	EMMONS
223	351	3	26.56	NORTH DAKOTA	SOUTH CENTRAL	EMMONS
223	351	4	28.05	NORTH DAKOTA	SOUTHEAST	LOGAN
223	352	1	26.66	SOUTH DAKOTA	NORTH CENTRAL	MC PHERSON
223	352	2	26.66	SOUTH DAKOTA	NORTH CENTRAL	CAMPBELL
223	352	3	26.92	NORTH DAKOTA	SOUTHEAST	MC INTOSH
223	352	4	26.92	NORTH DAKOTA	SOUTHEAST	MC INTOSH
223	353	1	26.75	SOUTH DAKOTA	NORTH CENTRAL	EDMUNDS
223	353	2	26.75	SOUTH DAKOTA	NORTH CENTRAL	EDMUNDS
223	353	3	26.88	SOUTH DAKOTA	NORTH CENTRAL	MC PHERSON
223	353	4	26.89	SOUTH DAKOTA	NORTH CENTRAL	MC PHERSON
223	354	1	26.69	SOUTH DAKOTA	NORTH CENTRAL	FAULK
223	354	2	26.69	SOUTH DAKOTA	NORTH CENTRAL	FAULK
223	354	3	26.69	SOUTH DAKOTA	NORTH CENTRAL	EDMUNDS
223	354	4	26.69	SOUTH DAKOTA	NORTH CENTRAL	EDMUNDS
223	355	1	25.50	SOUTH DAKOTA	CENTRAL	HAND
223	355	2	25.50	SOUTH DAKOTA	CENTRAL	HAND
223	355	3	27.00	SOUTH DAKOTA	NORTH CENTRAL	FAULK
223	355	4	27.00	SOUTH DAKOTA	NORTH CENTRAL	FAULK
223	356	1	25.41	SOUTH DAKOTA	CENTRAL	HAND
223	356	2	25.41	SOUTH DAKOTA	CENTRAL	HAND
223	356	3	25.41	SOUTH DAKOTA	CENTRAL	HAND

EARTH SATELLITE CORP.
ESTIMATED YIELD (BU/A)
STATES & CROP REPORTING DISTRICTS
PROJECTED FROM AUGUST 30, 1975

STATE	CROP REP. DIST.	YIELD
MONTANA		22.79
	NORTH CENTRAL	23.43
	NORTHEAST	22.19
	CENTRAL	25.49
	SOUTH CENTRAL	24.53
	SOUTHEAST	22.83
SOUTH DAKOTA		25.68
	NORTHWEST	24.11
	NORTH CENTRAL	26.45
	NORTHEAST	25.90
	WEST CENTRAL	23.80
	CENTRAL	25.00
	EAST CENTRAL	26.30
	SOUTHWEST	23.70
	SOUTH CENTRAL	25.87
	SOUTHEAST	24.98
NORTH DAKOTA		26.43
	NORTHWEST	24.53
	NORTH CENTRAL	27.03
	NORTHEAST	27.31
	WEST CENTRAL	24.96
	CENTRAL	26.71
	EAST CENTRAL	27.98
	SOUTHWEST	25.33
	SOUTH CENTRAL	26.78
	SOUTHEAST	28.17
MINNESOTA		28.86
	NORTHWEST	28.85
	NORTH CENTRAL	29.24
	WEST CENTRAL	28.91
	CENTRAL	28.74
	SOUTHWEST	28.17
	SOUTH CENTRAL	28.43

6.0 POST SEASON MODEL AND SITE ANALYSIS

To facilitate model analysis, programs were produced to extract selected cell data from the meteorologic and agronomic season data files. The single cell is then regrown through the season to analyze the AGMET model. These programs are as follows:

1. METSTRIP - extracts meteorological data
2. AGFORMAT - extracts historical initial season growth data
3. AGSITE - regrows selected cells

6.1 Data Extractions

6.1.1 Meteorological Data Extraction METSTRIP

6.1.1.1 Functional Description

Extracts one-cell season meteorological data from the season master file for the 91-day growing season and creates a file containing this subset of data. This subset constitutes one input to the AGSITE program.

6.1.1.2 Mathematical Description

- None -

6.1.1.3 METSTRIP EXECUTION

Job Control Language

```
//E3SRA JOB (5220,095,5,5,,,,,),'1052'
//    EXEC FORTGCLG
//FORT.SYSIN DD
```

-source code -

```
//LKED.SYSLIB DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.SYSIN DD *
```

- FT05F001 input data -

```
//GO.SYSUDUMP DD SYSOUT=A
//FT29F001 DD DSN=NONE,DISP=(OLD,KEEP,KEEP),UNIT=2400,
// VOL=(PRIVATE,RETAIN,SER=ESC056),LABEL=(2,BLP),
// DCB=(RECFM=FB,LRECL=20,BLKSIZE=3600,DEN=3)
//FT32F001 DD DUMMY,DCB=BLKSIZE=20
//FT31F001 DD DSN=MET,STRI1,DISP=(NEW,KEEP),
// UNIT=3330,VOL=(PRIVATE,RETAIN,SER=IPIWRK),
// SPACE=(CYL,(1,2),RLSE,CONTIG),DCB=(RECFM=FB,LRECL=20,BLKSIZE=2000)
```

Data Definition Description

LKED STEP

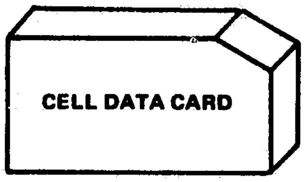
SYSLIB - assembler submarine library

GO STEP

FT29F001 - input MET season master
FT31FØØ1 - dummy file
FT32FØØ1 - output net subdile for AGSITE

6.1.1.4 METSTRIP DATA DESCRIPTION

FT05F001 INPUT DATA



1 CARD

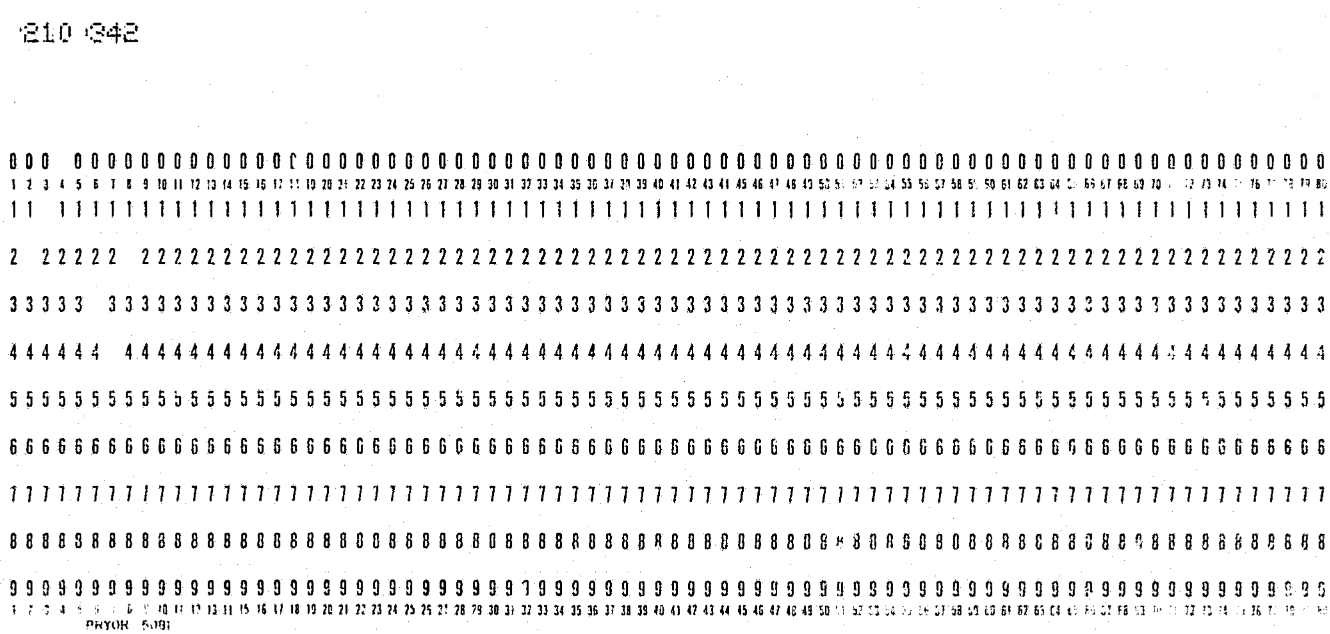
CELL DATA CARD

METSTRIP CELL DATA CARD

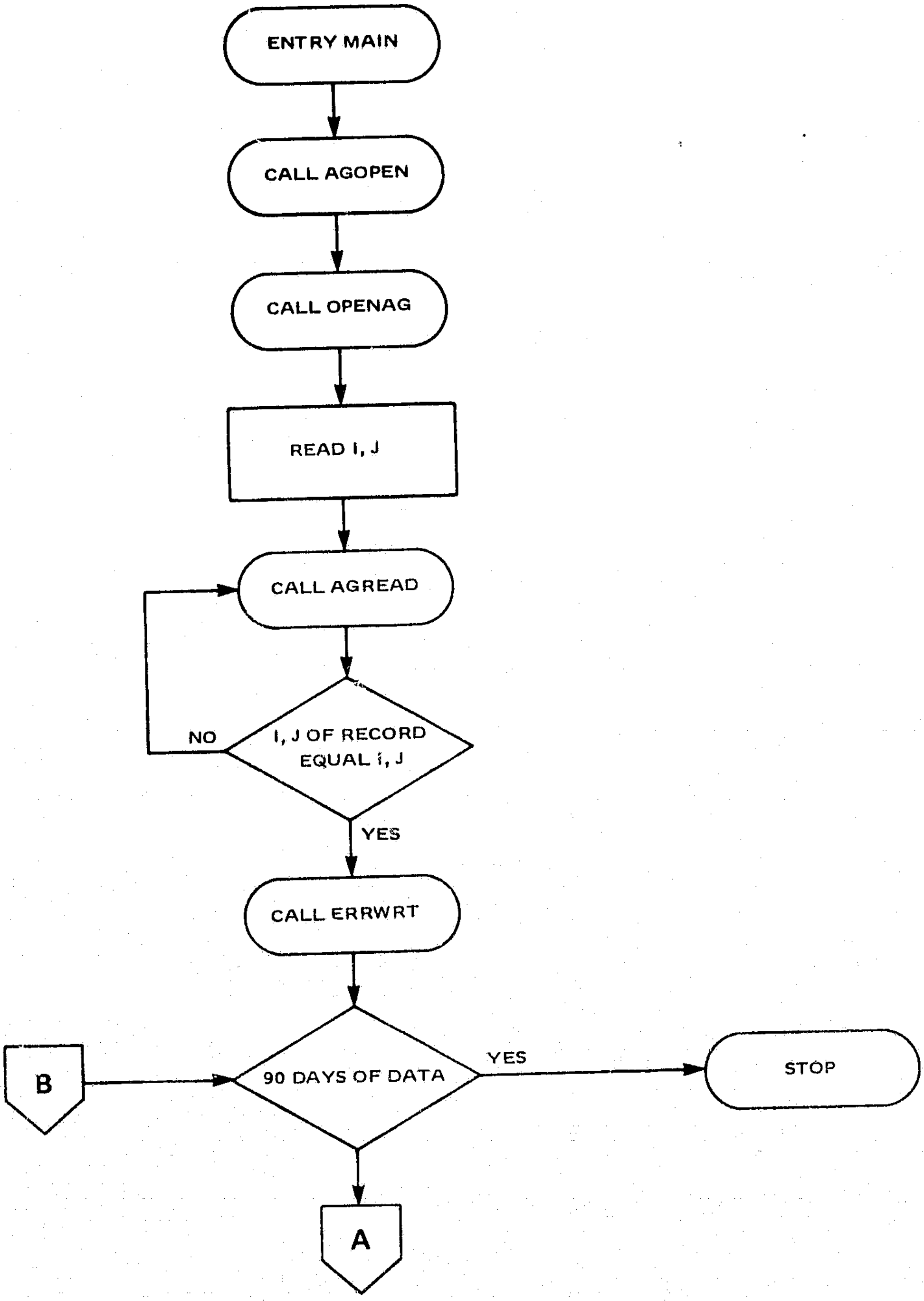
FORMAT: (2I4)

Variable	Format	Cols	Description
I	I4	1-4	I location
J	I4	5-8	J location

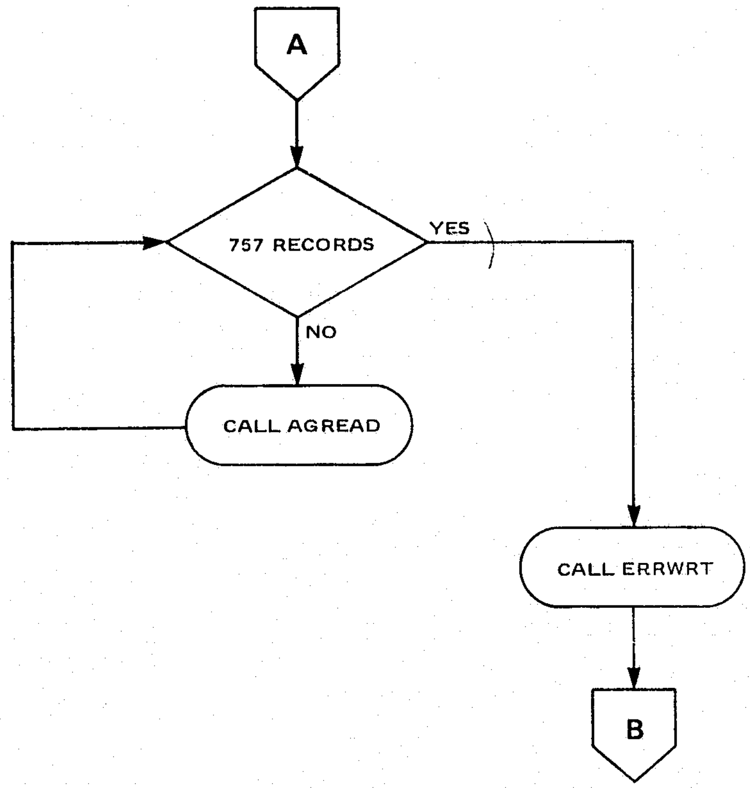
SAMPLE CARD:



METSTRIP


ENTRY MAIN
CALL AGOPEN
CALL OPENAG
READ I, J
CALL AGREAD
I, J OF RECORD EQUAL I, J
NO
YES
CALL ERRWRT
90 DAYS OF DATA
YES
STOP
B
A

C-4



6.1.1.6 SOURCE CODE

```
      INTEGER*2 A(10)
      READ(5,103) I,J
  103 FORMAT(2I4)
      CALL OPENAG
      CALL AGOPEN
   10 CONTINUE
      CALL AGREAD(A)
      I1=A(1)
      J1=A(2)
      IF(I1.NE.I.OR.J1.NE.J) GO TO 10
      CALL ERRWRT(A)
      DO 6 I=1,90
      DO 7 J=1,757
      CALL AGREAD(A)
    7 CONTINUE
      CALL ERRWRT(A)
    6 CONTINUE
      STOP
      END
```

6.1.2 Agronomic Data Extraction AGFORMAT

6.1.2.1 Functional Description

This program extracts specified cell data from the initial site season and agronomic historic file and creates a file containing this subset of data. This data is used for initialization of the AGSITE cell growth program.

6.1.2.2 Mathematical Description

- None -

6.1.2.3 AGFORMAT EXECUTION

Job Control Language

```
//AGFORMAT     JOB    (BR9001,746),'programmer name',CLASS=F

//FORT.SYSIN DD *

                                 - source code -

//LKED.SYSLIB DD
//    DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.SYSIN DD *

                              - FT05F001 data cards -

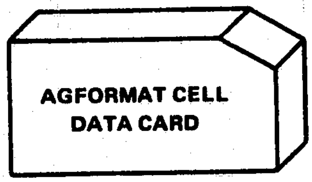
//HISTORIC DD DSN=HIST.G1,DISP=(OLD,KEEP),
//#UNIT=3330,VOL=(PRIVATE,RETAIN,SER=IPIWRK),
// DCB=(RECF=F,BLKSIZE=40)
//FT10F001 DD DSN=SEASON,SITE2,UNIT=3330,DISP=NEW,PASS),
//    VOL=SER=IPIWRK,SPACE=(CYL,(3),RLSE,CONTIG),
//    DCB=(RECFM=F,BLKSIZE=142)
//FT21F001 DD DSN=LACIE.START,DISP=(OLD,KEEP,KEEP),
// UNIT=3330,VOL=(PRIVATE,RETAIN,SER=IPIWRK),
```

Data Description

FT05F001 - card file for FT05F001
FT06F001 - print file
HISTORIC - historic agronimic file
FT10F001 - AGSITE file output
FT21F001 - start agronomic file

6.1.2.4 AGFORMAT DATA DESCRIPTION

FT05F001 DATA



1 CARD

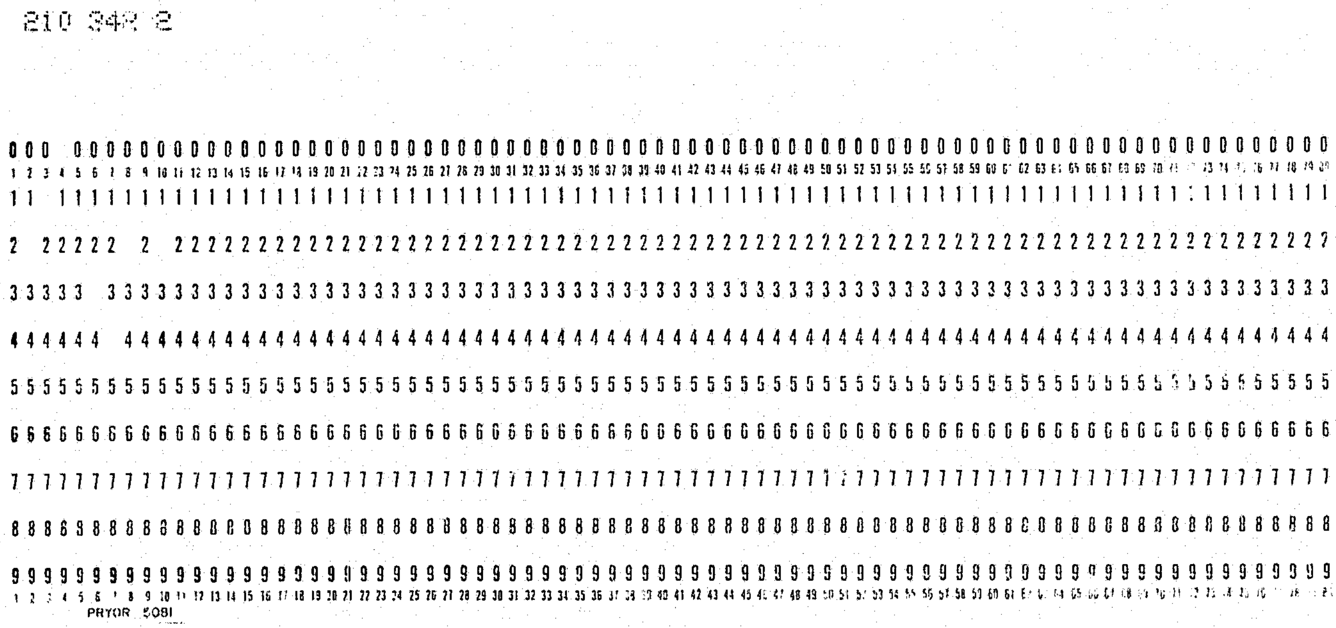
CELL DATA CARD

AGFORMAT Cell Data Card

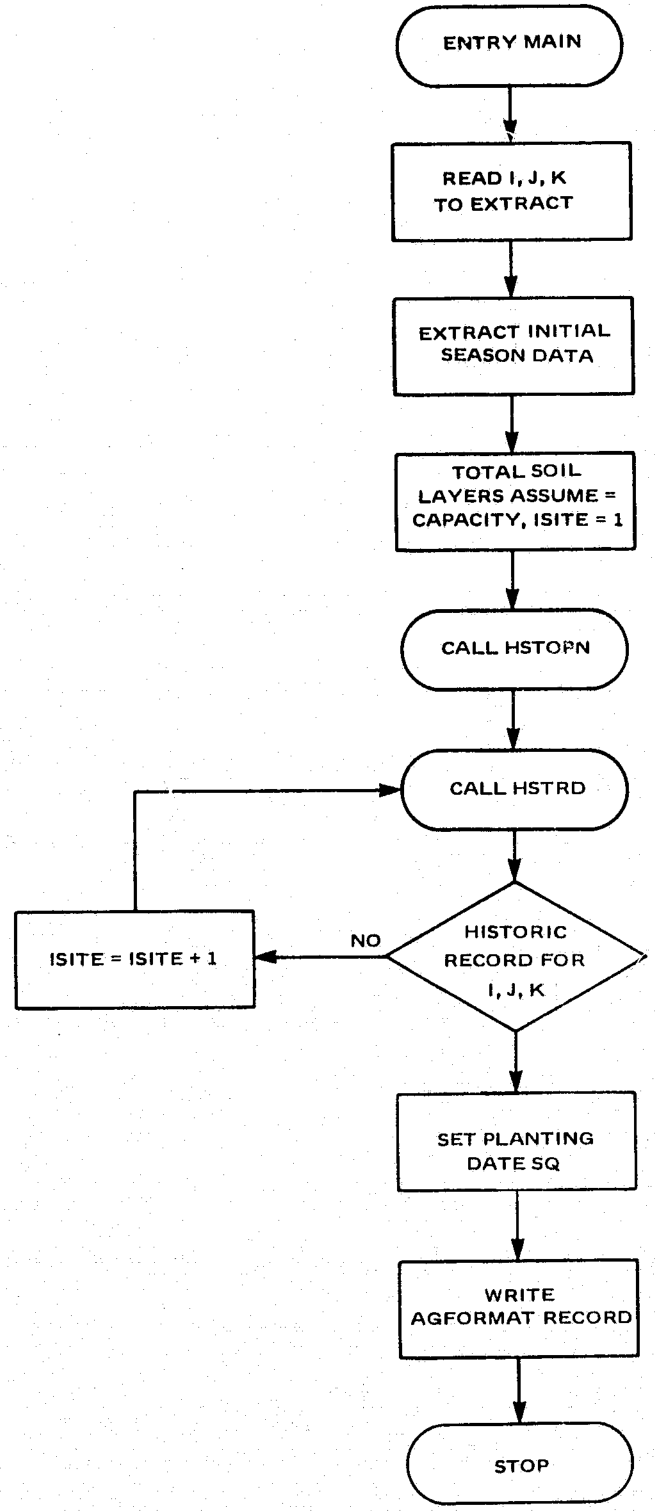
FORMAT: (2I4,I2)

Variable	Format	Cols	Description
I1	I4	1-4	I location
J1	I4	5-8	J location
K1	I2	9-10	K location

Sample Card:



PROGRAM AGFORMAT



6.2.1.6 SOURCE CODE

```
      REAL SM(3),ET(3),STRINT(5),COFR(80,3),RDFR(9,4),LAT,LON
      REAL SMC(3)
      INTEGER*2                NDAY(5),CRPDAY,TSOIL,RAD,ICDAY
      INTEGER*2               STATE,COUNTY,CRD,SOIL,PLNDAT,TSTSIT
      INTEGER*2 SQ
      COMMON/ARCHIV/I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,
     $  TMAX,TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
      COMMON/HIST/II,JJ,KK,LAT,LON,YLDTND,YLDADF,STATE,COUNTY,CRD,SOIL,
     $  PLNDAT,TSTSIT
      ISITE=1
      CALL HSTOPN(II)
      CALL OPENAG
 888  CONTINUE
      SQ=0
      READ(5,100,END=999) I1,J1,K1
 100  FORMAT(2I4,I2)
 10    CONTINUE
      READ(21,101)  I,J,K,JUL,BMT,SM,ET,ETP,ETPAVE,PRECIP,STRESS,
     $  TMAX,TMIN,CRNOFF,STRINT,NDAY,CRPDAY,TSOIL,RAD
 101  FORMAT(23A4,8A2)
      IF(I.NE.I1.OR.J.NE.J1.OR.K.NE.K1) GO TO 10
      DO 6 NIFT=1,3
      SMC(NIFT)=SM(NIFT)
 6    CONTINUE
 11   CONTINUE
      CALL HSTRD(ISITE)
      ISITE=ISITE+1
      IF(II.NE.I1.OR.JJ.NE.J1.OR.KK.NE.K1) GO TO 11
      IPLNDA=PLNDAT
      SQ=SQ+1
      WRITE(10,2001) I,J,K,JUL,BMT,(SM(L),L=1,3),(SMC(M),M=1,3),
     X (ET(L1),L1=1,3),ETP,ETPAVE,PRECIP,STRESS,TMAX,TMIN,CRNOFF,
     X (STRINT(L2),L2=1,5),LAT,LON,IPLNDA,SOIL,(NDAY(L3),L3=1,5),
     X CRPDAY,RAD,STATE,CRD,COUNTY,TSTSIT,SQ
      GO TO 888
 2001 FORMAT(29A4,13A2)
 999  CONTINUE
      STOP
      END
```

6.2 Agronomic Analysis AGSITE

6.2.1 AGSITE

6.2.1.1 Functional Description

This program regrows cells with extracted via AGSTRIP and AGFORMAT. This program as presented regrows selected cells with the model as implemented during the 1975 growing season. During the course of analysis, several versions with variations reflecting model and site analysis were introduced; however, the basic program flow remained the same.

6.2.1.2 Mathematical Description

Refer section 5.2.1.2.

6.2.1.3 AGSITE EXECUTION

Job Control Language

```
//AGSITE    JOB    (CR9001,746), 'programmer name',CLASS=F
//SITE EXEC FORTGCLG,PARM.FORT=ID,MAP',TIME.GO=5
//FORT.SYSIN DD *
```

- source code -

```
//LKED.SYSLIB DD DSN=EARTHSAT.LOADLIB,DISP=SHR
//GO.SYSUDUMP DD SYSOUT=A
//GO.SYSIN DD *
```

F05F001 input data

```
//HISTORIC DD DSN=SEASON.SITE2,UNIT=3330,DISP=(OLD,KEEP,KEEP),
//  VOL=(PRIVATE,RETAIN,SER=IPIWRK),DCB=(RECFM=F,BLKSIZE=142)
//FT12F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//FT13F001 DD DSN=MET.STRI1,DISP=(OLD,KEEP),
// UNIT=3330,VOL=(PRIVATE,RETAIN,SER=IPIWRK),
// SPACE=(CYL,(1,2),RLSE,CONTIG),DCB=(RECFM=FBL,LRECL=20,BLKSIZE=2000)
/*
//
```

Data Definition Description

LKED STEP

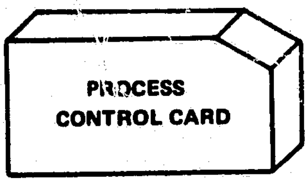
SYSLIB - assembler subroutine library

GO STEP

HISTORIC - agronomic season subfile generated by AGFORMAT
FT12F001 - printer file
FT13F001 - MET season subfile generated by METSTRIP

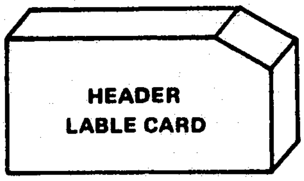
6.2.1.3 AGSITE DATA DESCRIPTION

FT05F001 DATA



1 CARD

PROCESS CONTROL CARD



1 CARD

HEADER LABLE CARD

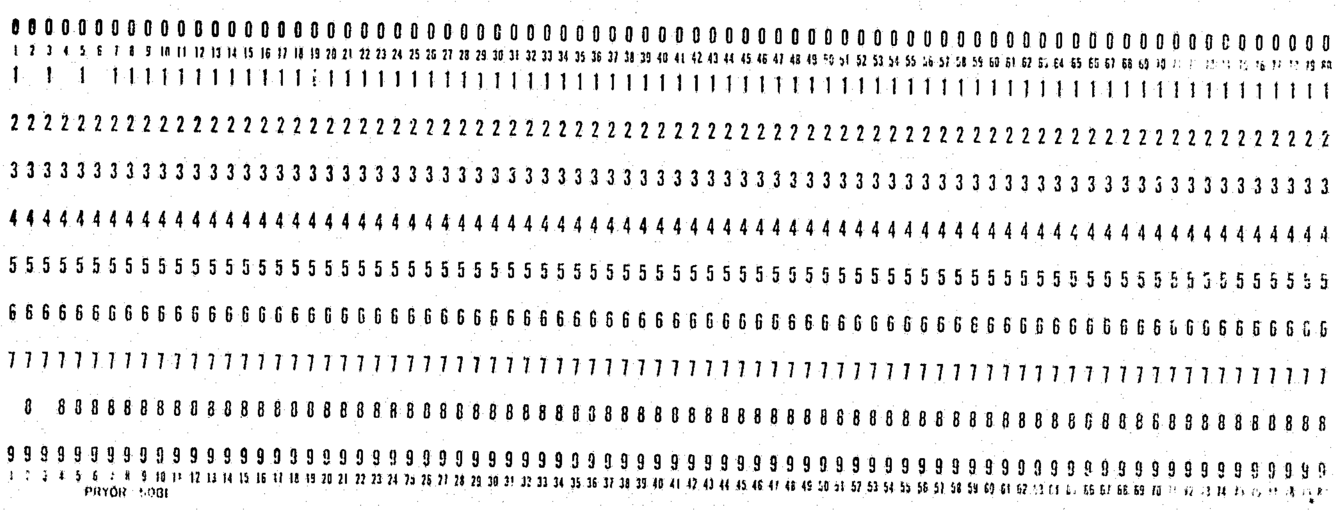
AGSITE PROCESS CONTROL CARD

FORMAT: (3I2)

Variable	Format	Cols	Description
NDAYS	I2	1-2	days in growing season
NDTP	I2	3-4	days to be processed
IRWA	I2	5-6	total cells to be processed

Sample Card:

8181 1

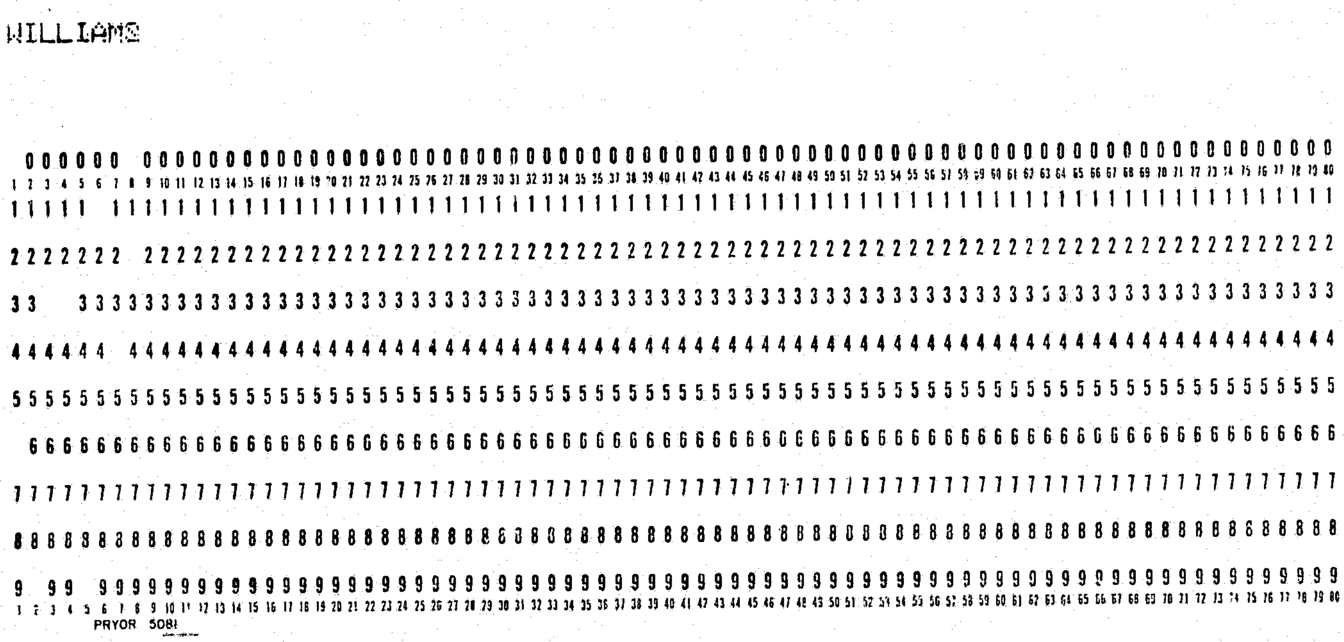


AGSITE HEADER LABEL DATA CARD

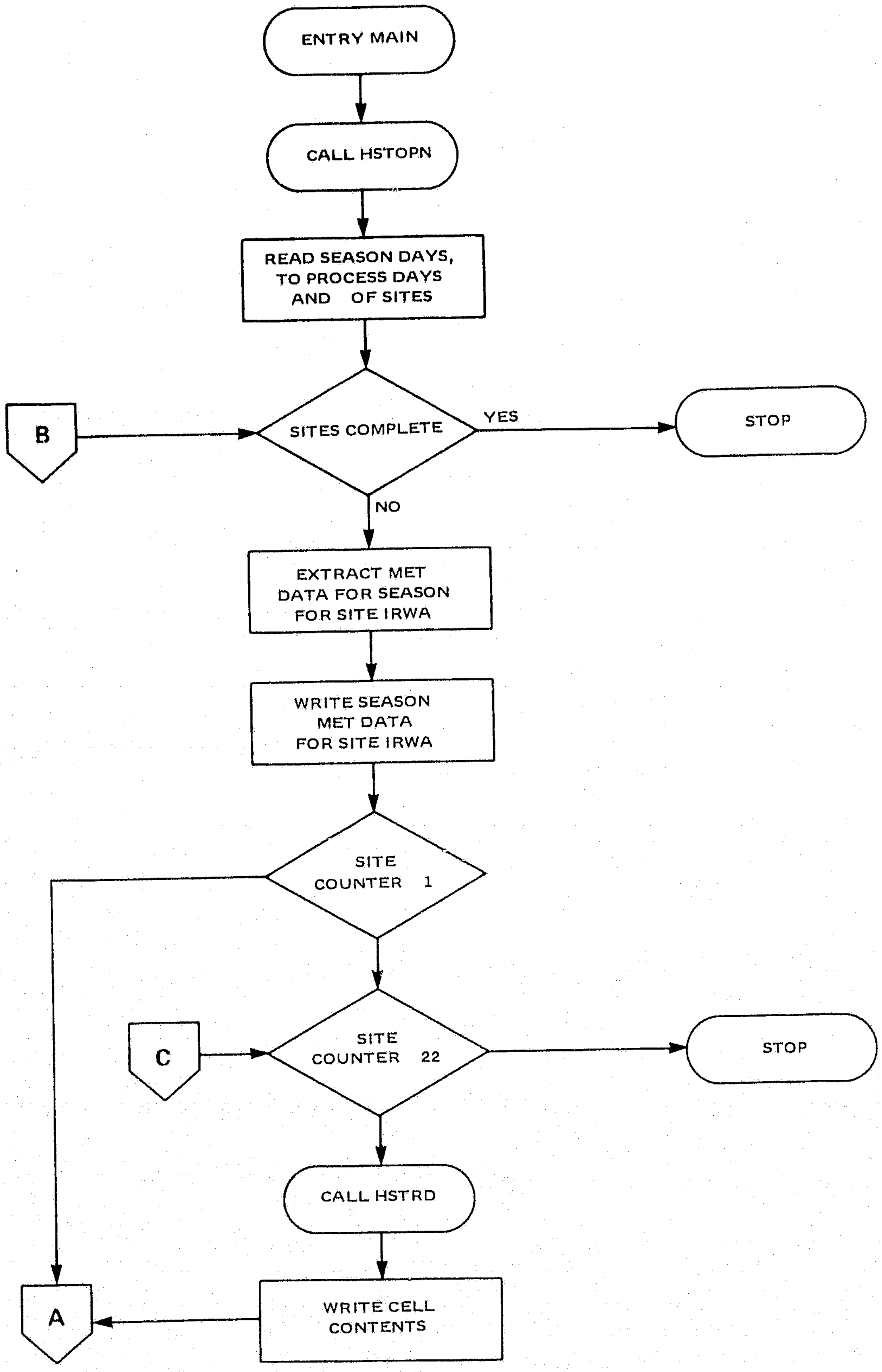
FORMAT: (3I4)

Variable	Format	Cols	Description
NAME (1,I)	A1	1-4	Ith cell name
NAME (2,I)	A1	5-8	
NAME (3,I)	A1	9-12	

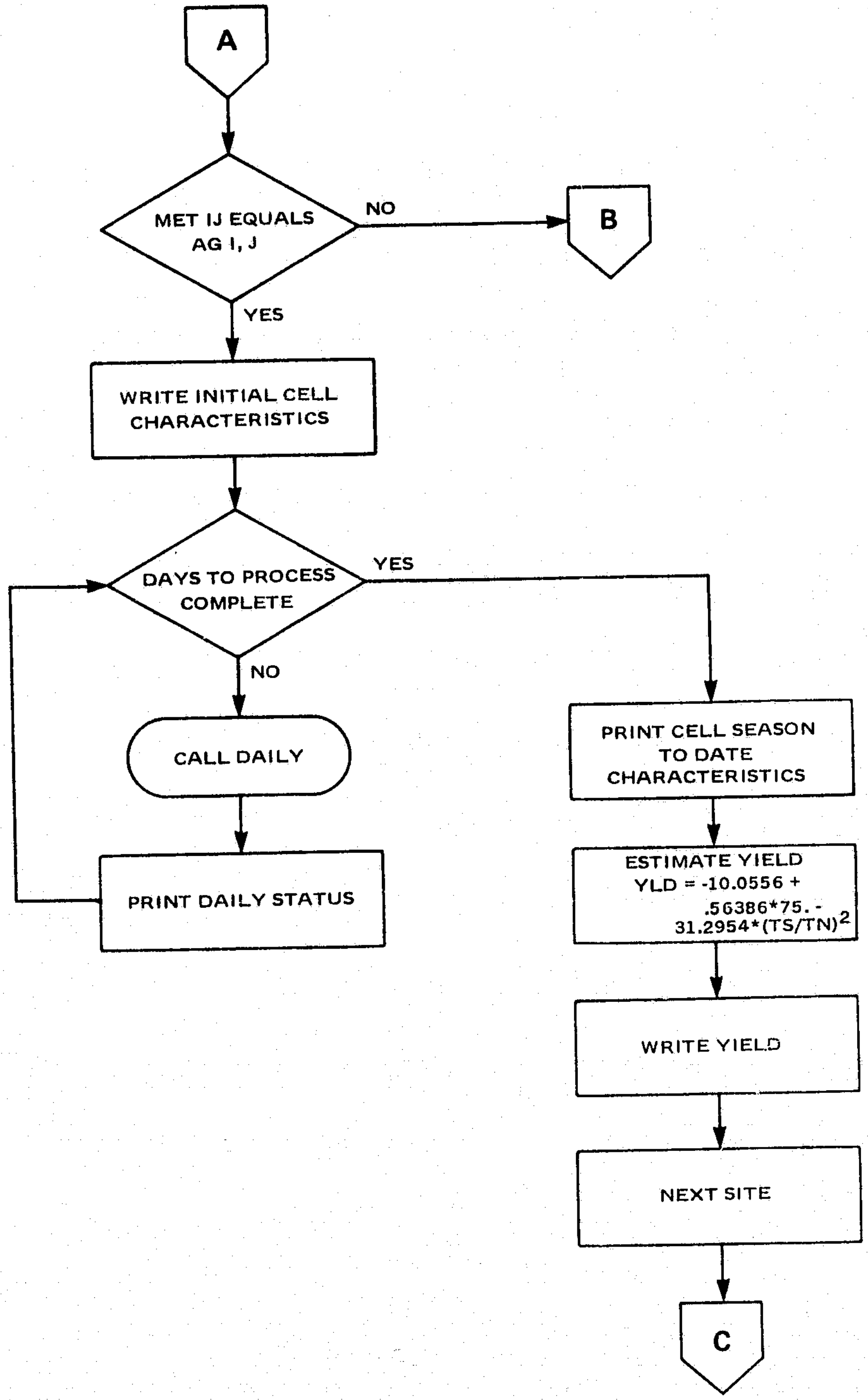
Sample Card



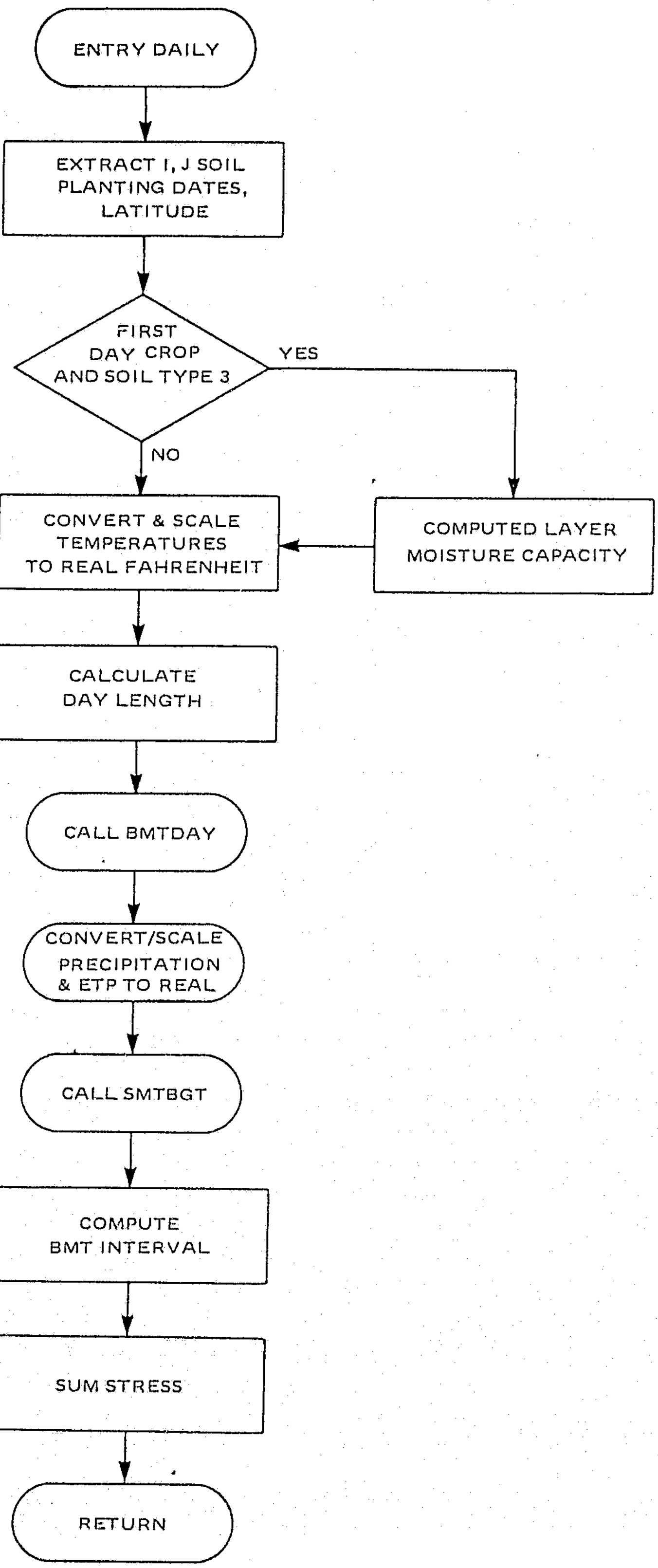
AGSITE



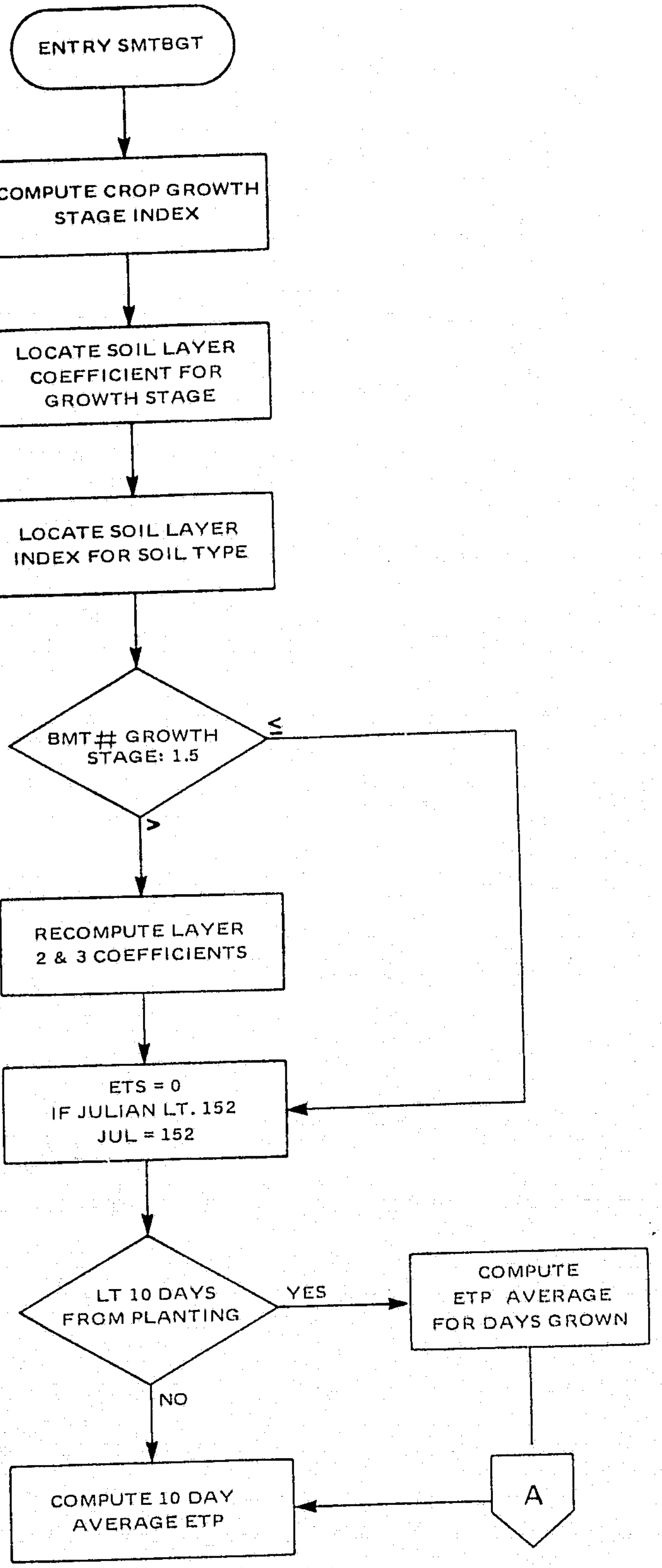
ENTRY MAIN
CALL HSTOPN
READ SEASON DAYS, TO PROCESS DAYS AND OF SITES
B
SITES COMPLETE
YES
STOP
NO
EXTRACT MET DATA FOR SEASON FOR SITE IRWA
WRITE SEASON MET DATA FOR SITE IRWA
SITE COUNTER 1
C
SITE COUNTER 22
STOP
CALL HSTRD
WRITE CELL CONTENTS
A


A
MET IJ EQUALS AG I, J
NO
B
YES
WRITE INITIAL CELL CHARACTERISTICS
DAYS TO PROCESS COMPLETE
YES
NO
CALL DAILY
PRINT DAILY STATUS
PRINT CELL SEASON TO DATE CHARACTERISTICS
ESTIMATE YIELD YLD = -10.0556 + .56386*75. - 31.2954*(TS/TN)2
WRITE YIELD
NEXT SITE
C

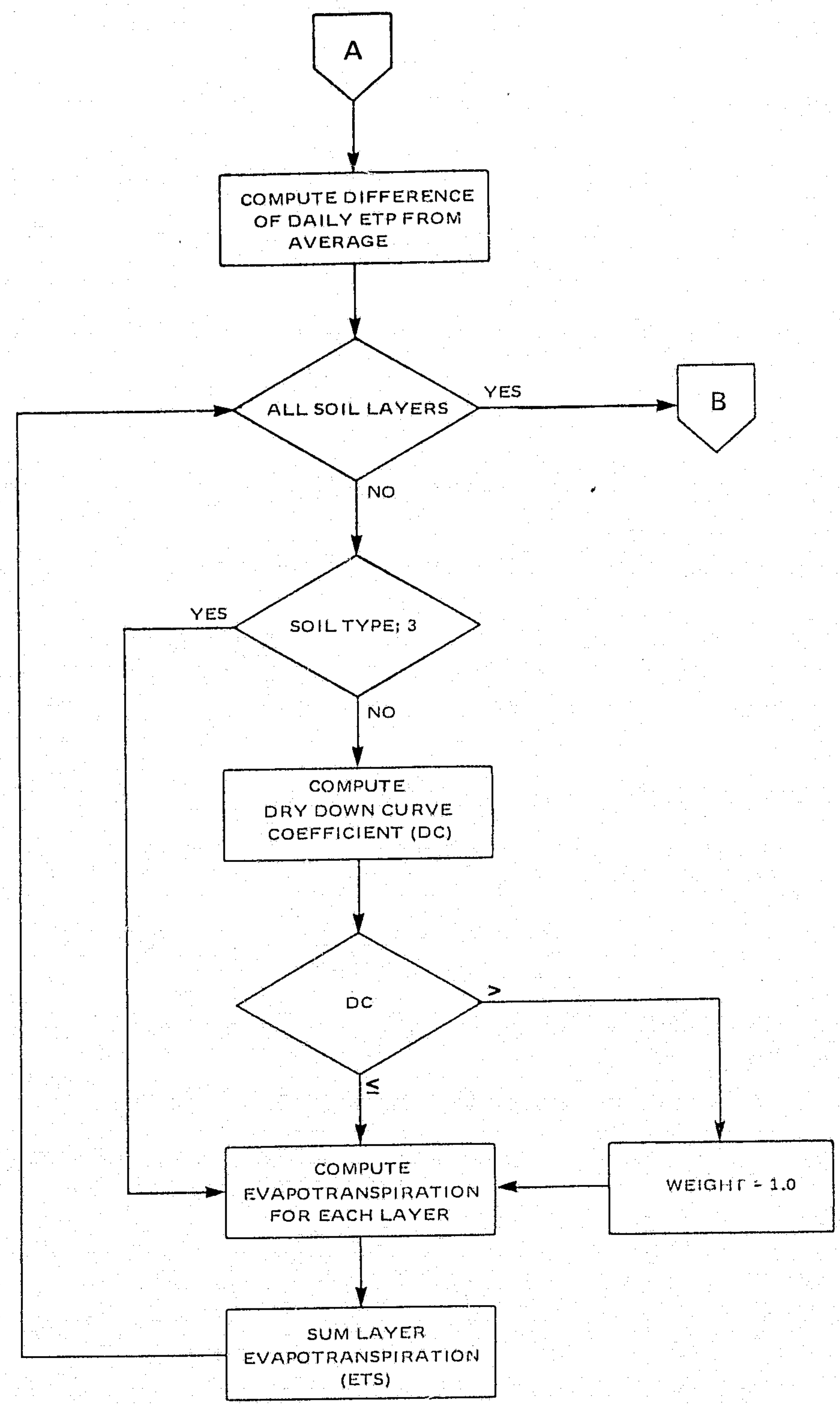
SUBROUTINE DAILY



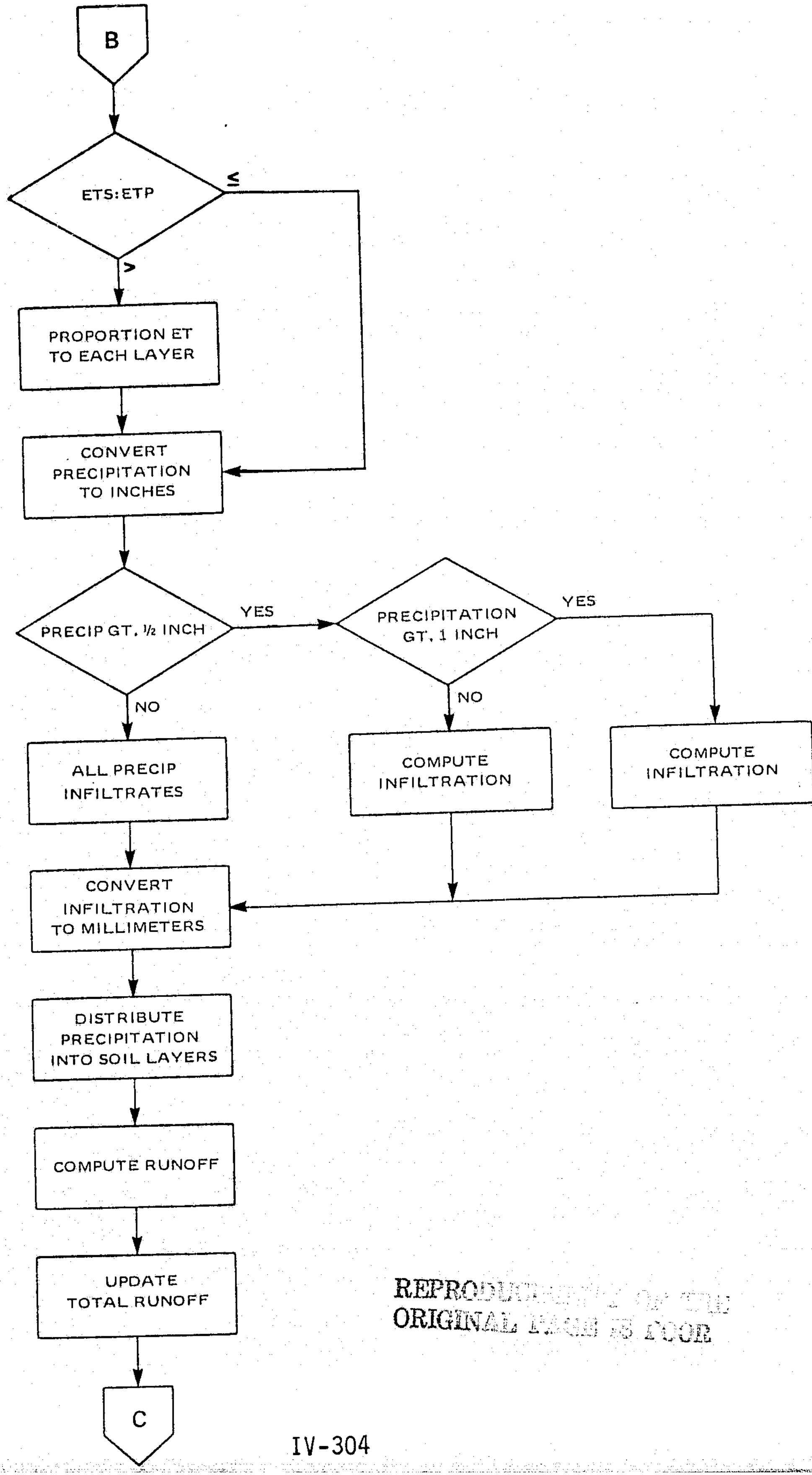
SUBROUTINE SMTBGT



SMTBGT

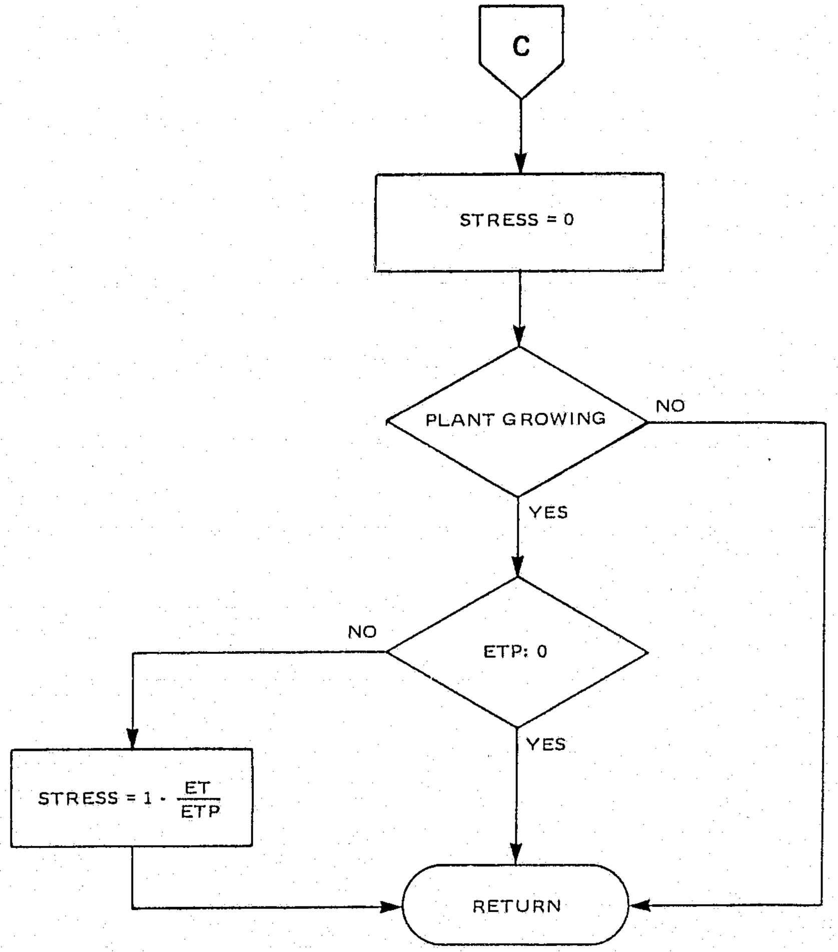

A
COMPUTE DIFFERENCE OF DAILY ETP FROM AVERAGE
ALL SOIL LAYERS
YES
B
NO
SOIL TYPE; 3
YES
NO
COMPUTE DRY DOWN CURVE COEFFICIENT (DC)
DC
>
≤
COMPUTE EVAPOTRANSPIRATION FOR EACH LAYER
WEIGHT = 1.0
SUM LAYER EVAPOTRANSPIRATION (ETS)

SMTBGT



B
ETS:ETP
≤
>
PROPORTION ET TO EACH LAYER
CONVERT PRECIPITATION TO INCHES
PRECIP GT. ½ INCH
YES
NO
PRECIPITATION GT. 1 INCH
YES
NO
ALL PRECIP INFILTRATES
COMPUTE INFILTRATION
COMPUTE INFILTRATION
CONVERT INFILTRATION TO MILLIMETERS
DISTRIBUTE PRECIPITATION INTO SOIL LAYERS
COMPUTE RUNOFF
UPDATE TOTAL RUNOFF
C

SMTBGT


C
STRESS = 0
PLANT GROWING
NO
YES
NO
ETP: 0
YES
STRESS = 1 - ET/ETP
RETURN

6.2.1.6 SOURCE CODE

```
      INTEGER*2 CELMET(10,100)/1000*0/
      INTEGER*2 NDAY(5),CRPDAY,SOIL,RAD,STATE,CRD,CNTY,SITNO,SEQNO,
     X I1,J1,PREC,PET,RNET,SOLAR,MAXT,MINT,BMT1,IDM,JUL1,A(11)
      INTEGER NAME(3,6)/'GLAC','IER',' ','ANRO','N',' ',
     X 'MANH','ATTE','N','DIVI','DE',' ','BURK','E',' ','HAND',' ',' '/
      INTEGER PLNDAT
      REAL SM(3),SMC(3),ET(3),LAT,LON,STRINT(5)
      COMMON/TSTARC/I,J,K,JUL,BMT,SM,SMC,ET,ETP,ETPAVE,PRECIP,
     X STRESS,TMAX,TMIN,CRNOFF,STRINT,LAT,LON,PLNDAT,SOIL,NDAY,CRPDAY,
     X RAD,STATE,CRD,CNTY,SITNO,SEQNO
      COMMON/TDUMP/INFILT,RUNOFF
      COMMON/METDAY/I1,J1,PREC,PET,RNET,SOLAR,MAXT,MINT,BMT1,IDM
      ISITE=0
      CALL HSTOPN(1)
      READ(5,2000) NDAYS,NDTP,IRWA
 2000 FORMAT(3I2)
      DO 6 III=1,IRWA
      READ(5,100)         (NAME(J,III),J=1,3)
    6 CONTINUE
  100 FORMAT(3A4)
C
      DO 500 NCELL=1,IRWA
C
C        READ 'NDAYS' MET DATA
C
      DO 10 L=1,NDAYS
      READ(13,2001)(CELMET(M,L),M=1,10)
 2001 FORMAT(10A2)
 10   CONTINUE
C        DUMP DATA FOR THIS CELL
      WRITE(6,2002)((CELMET(L,M),L=1,10),M=1,NDAYS)
 2002 FORMAT(10(2X,I5))
      IF(NCELL.GT.1) GO TO 25
C        GET NEXT TEST SITE
  20  CONTINUE
      IF(ISITE.GE.IRWA) STOP
      CALL HSTRD(ISITE)
      WRITE(6,2010) I,J,K,JUL,BMT,(SM(L1),L1=1,3),(SMC(L2),L2=1,3),
     X (ET(L3),L3=1,3),ETP,ETPAVE,PRECIP,STRESS,TMAX,TMIN,CRNOFF,
     X (STRINT(L4),L4=1,5),LAT,LON,PLNDAT,SOIL,(NDAY(L5),L5=1,5),
     X CRPDAY,RAD,STATE,CRD,CNTY,SITNO,SEQNO
 2010 FORMAT(///,4I4,F5.2,9F8.2,/,12F8.2,/,2F7.2,14I4)
 25   I2=CELMET(1,1)
      J2=CELMET(2,1)
      IF(I2.EQ.I.AND.J2.EQ.J) GO TO 30
C        MISMATCH - GET NEXT MET SEQUENCE
      GO TO 500
C        CELL MATCH
 30   IST=SITNO
      WRITE(12,2003)(NAME(M,IST),M=1,3),SEQNO
 2003 FORMAT(1H1,/,11X,'SITE: ',2A4,A1,' #',I1)
      IF(SOIL.NE.27) GO TO 40
      SMTS=0.0
      DO 41 NS=1,3
      SMTS=SMC(NS)+SMTS
  41   CONTINUE
      SMC(1)=.05*SMTS
      SMC(2)=.20*SMTS
```

```
      SMC(3)=.75*SMTS
      SM(1)=SMC(1)
      SM(2)=SMC(2)
      SM(3)=SMC(3)
 40    CONTINUE
      WRITE(12,2004)(SMC(M),M=1,3)
2004  FORMAT(/,21X,' SM(1)   SM(2)   SM(3) ',/,11X,'CAPACITY ' 3F7.2)
      WRITE(12,2005)
2005  FORMAT(69X,'AVE',15X,'TEMP (C)',/,10X,' JUL    BMI ',21X,
     X ' ET(1)  ET(2)  ET(3)  ETP  ETP  PREC   STR   MAX  MIN ',
     X '  RUNOFF  CRNOFF  CRPDAY  RAD',/)
      DO 50 IDAY=1,NDTP
      I1=CELMET(1,IDAY)
      J1=CELMET(2,IDAY)
      PREC=CELMET(3,IDAY)
      PET=CELMET(4,IDAY)
      RNET=CELMET(5,IDAY)
      SOLAR=CELMET(6,IDAY)
      MAXT=CELMET(7,IDAY)
      MINT=CELMET(8,IDAY)
      BMT1=CELMET(9,IDAY)
      CALL DAILY
C         PRINT STATUS
      WRITE(12,2006) JUL,BMT,(SM(L),L=1,3),(ET(M),M=1,3),ETP,
     X ETPAVE,PRECIP,STRESS,TMAX,TMIN,RUNOFF,CRNOFF,CRPDAY,RAD
2006  FORMAT(10X,I4,1X,F5.2,6F7.2,2F5.1,F6.1,F6.2,2F6.1,2F8.2,4X,
     X I3,2X,I4)
C         END CYCLE
50    CONTINUE
C         SUMMARIZE THIS TEST SITE
      WRITE(12,2007)
2007  FORMAT(//,48X,'SUMMARY OF YEAR TO DATE',//,46X,'INTERVAL  TOTAL',
     X ' STR  NO. DAY  AVGSTR')
      TS=0.
      TN=0.
      DO 60 L=1,5
      ND=NDAY(L)
      IF(ND.LT.1) GO TO 60
      AS=STRINT(L)
      TS=TS+AS
      TN=TN+FLOAT(ND)
      AVG=AS/FLOAT(ND)
      WRITE(12,2008) L,AS,ND,AVG
2008  FORMAT(50X,I1,4X,F5.2,4X,I3,5X,F4.2)
60    CONTINUE
C         ESTIMATE YIELD
      YLD=-10.0556+0.58386*75.-31.2954*(TS/TN)**2.
      IF(YLD.LT.0.0) YLD=0.0
      WRITE(12,2009) JUL,YLD
2009  FORMAT(/,46X,'ESTIMATED YIELD (PLANTING - ',I3,') ',F5.2)
C         FINISH LOOP
      ISITE=ISITE+1
      GO TO 20
500   CONTINUE
      STOP
      END
```

```
      SUBROUTINE DAILY
      INTEGER*2 NDAY(5),CRPDAY,ISOIL,MAXT,MINT,RAD,STATE,CRD,CNTY,
     X BMT1,RNET,PET,SOLAR,I1,J1,PREC,SITNO,SEQNO
      INTEGER PLNDAT
      INTEGER*2 IDM,IDT,SOIL
      REAL LAT,LON
      REAL BMT,SM(3),ET(3),ETP,ETPAVE,PRECIP,STRESS,STRINT(5),SMC(3)
      DATA R/0.01745329/
      COMMON/TEMPF/DAYLEN,TMAXF,TMINF
      COMMON/TSTARC/I,J,K,JUL,BMT,SM,SMC,ET,ETP,ETPAVE,PRECIP,
     X STRESS,TMAX,TMIN,CRNOFF,STRINT,LAT,LON,PLNDAT,SOIL,NDAY,CRPDAY,
     X RAD,STATE,CRD,CNTY,SITNO,SEQNO
      COMMON/METDAY/I1,J1,PREC,PET,RNET,SOLAR,MAXT,MINT,BMT1,IDM
      I2=I-205
      J2=J-334
      K2=K
10    MT=MAXT
      TMAX=FLOAT(MT)/10.
      TMAXF=1.8*TMAX+32.
      MT=MINT
      TMIN=FLOAT(MT)/10.
      TMINF=1.8*TMIN+32.
      RAD=RNET
C
C        CALCULATE DAYLENGTH
C
      JUL=JUL+1
      DAY=JUL
      EPH=23.5*SIN(0.9863*(DAY-80.)*R)
      COH=-TAN(LAT*R)*TAN(EPH*R)
      DAYLEN=ARCOS(COH)*7.640767
C
C        CALCULATE NEW BMT VALUE
C
      BMT=4.5
      S=BMT1
      BMT=S/1000
C
      MT=PET
      ETP=FLOAT(MT)/10.
      MT=PREC
      PRECIP=FLOAT(MT)/10.
      IBMT=IFIX(BMT)+1
C
C        CALCULATE SOIL MOISTURE AND PLANT STRESS
C
      CALL SMTBGT
C
C        DAY'S GROWTH COMPLETE - RETURN
C
      IF(IBMT.LT.1.OR.IBMT.GT.5) GO TO 20
      NDAY(IBMT)=NDAY(IBMT)+1
      STRINT(IBMT)=STRINT(IBMT)+STRESS
      CRPDAY=CRPDAY+1
20    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SMTWGT
      INTEGER*2 NDAY(5),CRPDAY,RAD,STATE,CRD,CNTY,SEGNO,SITNO
      INTEGER*2 SOIL
      INTEGER*2 SOILC(3,27)/5*1,3,1,1,4,1,3,1,1,3,3,1,3,4,1,4,1,1,4,3,
     X1,4,4,3,1,1,3,1,3,3,1,4,3,3,1,5*3,4,3,4,1,3,4,3,3,4,4,
     X4,1,1,4,1,3,4,1,4,4,3,1,4,3,3,4,3,3*4,1,4,4,3,3*4/
      INTEGER PLNDAT,S(3)
      REAL SM(3),ET(3),STRINT(5),SMC(3),LAT,LON
      REAL INFILT,C(3)
      DATA FACTOR/0.0522296/
      REAL C1(3,6)/.6,.2,0.,.5,.2,0.,.55,.3,0.,.4,.35,.15,.45,.35,.2,
     X .45,.35,.1/
      COMMON/TSTARC/I,J,K,JUL,BMT,SM,SMC,ET,ETP,ETPAVE,PRECIP,
     X STRESS,TMAX,TMIN,CRNOFF,STRINT,LAT,LON,PLNDAT,SOIL,NDAY,CRPDAY,
     X RAD,STATE,CRD,CNTY,SITNO,SEGNO
      COMMON/TOGMP/INFILT,RUNOFF
      IBMT=BMT+2.0
      IF(IBMT.GT.6.0.OR.IBMT.LT.1) IBMT=1
      DO 10 I2=1,3
      C(I2)=C1(I2,IBMT)
      S(I2)=SOILC(I2,SOIL)
10    CONTINUE
      IF(BMT.LE.1.5) GO TO 100
      C(2)=C(2)*(1.+C(1)*(1.-SM(1)/SMC(1)))
      C(3)=C(3)*(1.+C(1)*(1.-SM(1)/SMC(1))
     X                  +C(2)*(1.-SM(2)/SMC(2)))
  100 CONTINUE
      ETS=0.
C         FOLLOWING CALCULATION ASSUMES A MODEL START OF 1 JUNE
C         AND MODIFIES ETPAVE ACCORDINGLY
      IF(JUL.LT.152) JUL=152
      IF(JUL-161) 110,120,120
110   ND=JUL-152
      NT=ND+1
      F1=FLOAT(ND)/FLOAT(NT)
      F2=1./FLOAT(NT)
      ETPAVE=F1*ETPAVE+F2*ETP
      GO TO 130
120   ETPAVE=0.9*ETPAVE+0.1*ETP
C
130   DEVETP=ETP-ETPAVE
      DO 200 L=1,3
      DC=1.0
      IF(S(L).EQ.3)  GO TO 150
      X=70.-150.*(SM(L)/SMC(L))
      DC=1.0/(1.0+EXP(FACTOR*X))
      IF(X.LT.0.) DC=1.0
150   ET(L)=C(L)*DC*ETP*EXP(-.01*DEVETP*(7.31-11.0*SM(L)/SMC(L)))
      IF(ET(L).GT.SM(L)) ET(L)=SM(L)
      ETS=ETS+ET(L)
  200 CONTINUE
      IF(ETS.LE.ETP) GO TO 205
      DO 204 L=1,3
204   ET(L)=ET(L)*ETP/ETS
  205 CONTINUE
      PCPINH=PRECIP*0.03937
      IF(PCPINH.GT.0.5) GOTO 210
      INFILT=PCPINH
```

```
      GOTO 230
  210 CONTINUE
      IF(PCPINH.GE.1.0) GOTO 220
      INFILT=(PCPINH-0.5)*0.6354+0.5
      GOTO 230
  220 CONTINUE
      INFILT=0.9177+ALOG(PCPINH)*(1.811-0.97*SM(1)/SMC(1))
  230 CONTINUE
      INFILT=INFILT/.03937
      IF(INFILT.GT.PRECIP) INFILT=PRECIP
      EXCESS=INFILT
      DO 500 L=1,3
      SM(L)=SM(L)+EXCESS-ET(L)
      EXCESS=SM(L)-SMC(L)
      IF(EXCESS.LT.0.0) EXCESS=0.0
      IF(L.EQ.3) RUNOFF=PRECIP-INFILT+EXCESS
      IF(SM(L).GE.0.0) GO TO 300
      SM(L)=0.0
      GOTO 400
  300 CONTINUE
      IF(SM(L).GT.SMC(L)) SM(L)=SMC(L)
  400 CONTINUE
  500 CONTINUE
      STR=0.
      CRNOFF=CRNOFF+RUNOFF
      IF(BMT.LE.-0.5) GO TO 2700
      ETS=ET(1)+ET(2)+ET(3)
      IF(ETP.GT.0.0) STRESS=1.0-ETS/ETP
      IF(STRESS.LT.0.0) STRESS=0.0
 2700 RETURN
      END
```

205	3.46	0.0	6.48	26.37	3.22	1.19	0.68	9.4	8.1	0.0	0.46	34.1	12.5	0.0	30.85	61	473
206	3.52	0.0	5.11	25.28	0.0	1.37	1.09	10.9	8.4	0.0	0.77	35.5	15.3	0.0	30.85	62	380
207	3.58	0.50	4.26	24.27	0.0	0.25	1.01	10.5	8.6	0.5	0.82	35.0	15.5	0.00	30.85	63	471
208	3.64	0.25	3.64	23.33	0.24	0.62	0.95	11.2	8.8	0.0	0.84	39.8	14.3	0.0	30.85	64	408
209	3.70	2.02	3.25	22.68	0.14	0.39	0.65	7.3	8.7	1.9	0.84	38.2	18.4	0.00	30.85	65	136
210	3.75	3.22	3.72	22.19	1.27	0.27	0.48	6.8	6.5	3.2	0.70	29.7	16.7	0.00	30.85	66	221
211	3.79	3.22	5.58	21.99	1.20	0.14	0.20	3.1	8.0	3.2	0.50	23.1	16.4	0.00	30.85	67	119
212	3.81	3.22	6.78	21.72	2.03	0.37	0.28	4.9	7.6	3.6	0.45	18.5	11.8	0.00	30.85	68	272
213	3.84	3.22	6.50	21.39	2.73	0.65	0.32	6.3	7.5	3.1	0.41	24.8	11.2	0.00	30.85	69	255
214	3.89	0.0	5.61	20.94	3.22	0.89	0.46	10.1	7.8	0.0	0.55	29.5	12.6	0.0	30.85	70	378
215	3.93	2.40	4.82	20.40	0.0	0.79	0.54	7.8	7.8	2.4	0.83	28.5	13.9	0.00	30.85	71	216
216	3.97	0.20	4.45	20.08	2.40	0.37	0.31	5.7	7.6	0.2	0.46	28.0	12.5	0.00	30.85	72	146
217	4.02	0.38	3.93	19.83	0.12	0.52	0.25	7.8	7.6	0.3	0.89	33.7	13.7	0.00	30.85	73	270
218	4.14	1.71	3.46	19.56	0.17	0.47	0.27	9.1	7.7	1.5	0.90	34.4	14.6	0.00	30.85	74	374
219	4.26	3.22	3.84	19.39	0.64	0.27	0.17	6.2	7.6	3.0	0.79	24.4	15.1	0.00	30.85	75	166
220	4.35	0.0	3.47	19.17	3.22	0.37	0.22	11.2	7.9	0.0	0.66	26.5	12.3	0.0	30.85	76	421
221	4.42	0.0	3.06	18.91	0.0	0.41	0.27	8.8	8.0	0.0	0.92	28.2	8.4	0.0	30.85	77	473
222	4.51	0.0	2.68	18.62	0.0	0.38	0.29	10.1	8.2	0.0	0.93	30.6	10.5	0.0	30.85	78	467
223	4.61	0.0	2.35	18.33	0.0	0.33	0.29	10.1	8.4	0.0	0.94	29.9	11.9	0.0	30.85	79	455
224	4.71	0.0	2.12	18.13	0.0	0.23	0.20	6.4	8.2	0.0	0.93	24.6	12.7	0.0	30.85	80	304
225	4.81	0.0	1.91	17.92	0.0	0.21	0.20	6.7	8.1	0.0	0.94	26.7	11.7	0.0	30.85	81	313
226	4.90	2.70	1.76	17.78	0.0	0.15	0.15	4.5	7.7	2.7	0.93	21.9	12.0	0.00	30.85	82	194
227	4.97	0.70	1.62	17.62	2.70	0.14	0.16	7.5	7.7	0.7	0.60	28.3	8.4	0.00	30.85	83	412
228	-1.00	1.96	1.56	17.62	0.24	0.05	0.0	4.7	7.4	1.5	0.60	19.8	10.3	0.00	30.85	83	171
229	-1.00	1.59	1.51	17.62	1.06	0.05	0.0	4.5	7.1	0.7	0.60	22.7	11.3	0.00	30.85	83	189
230	-1.00	3.22	4.10	[illegible]	0.83	0.05	0.0	5.2	6.9	5.1	0.60	22.3	12.4	0.00	30.85	83	317
231	-1.00	3.22	11.49	17.62	2.40	0.11	0.0	4.3	6.7	9.9	0.60	22.4	12.8	0.00	30.85	83	269
232	-1.00	3.22	12.88	16.78	2.80	0.95	0.0	4.9	6.5	6.3	0.60	24.2	14.2	0.00	30.85	83	236
233	-1.00	0.0	11.03	16.78	3.22	1.85	0.0	6.7	6.7	0.0	0.60	26.7	12.4	0.0	30.85	83	433
234	-1.00	3.22	12.38	23.39	0.0	2.12	0.0	10.1	7.0	11.8	0.60	27.7	16.3	0.00	30.85	83	407
235	-1.00	1.40	11.58	23.39	3.22	1.30	0.0	6.6	7.0	1.4	0.60	25.4	13.2	0.00	30.85	83	164
236	-1.00	3.22	12.38	31.94	0.58	0.86	0.0	4.5	6.7	13.2	0.60	17.1	9.3	0.08	30.93	83	115
237	-1.00	3.22	12.88	34.22	3.22	1.11	0.0	5.7	6.6	5.6	0.60	19.4	7.4	0.00	30.93	83	300
238	-1.00	0.0	11.68	34.22	3.22	1.20	0.0	6.1	6.6	0.0	0.60	24.8	7.7	0.0	30.93	83	367
239	-1.00	0.0	10.01	34.22	0.0	1.67	0.0	8.1	6.7	0.0	0.60	31.9	11.6	0.0	30.93	83	400
240	-1.00	0.0	7.95	34.22	0.0	2.06	0.0	10.1	7.1	0.0	0.60	31.4	13.0	0.0	30.93	83	442
241	-1.00	0.0	7.23	34.22	0.0	0.72	0.0	9.4	7.3	0.0	0.60	24.4	10.1	0.0	30.93	83	449
242	-1.00	0.0	6.66	34.22	0.0	0.57	0.0	9.0	7.5	0.0	0.60	25.3	9.0	0.0	30.93	83	435

SUMMARY OF YEAR TO DATE

INTERVAL	TOTAL STR	NO. DAY	AVGSTR
1	3.06	9	0.34
2	13.18	24	0.55
3	6.52	18	0.36
4	12.51	21	0.60
5	9.44	11	0.86

ESTIMATED YIELD (PLANTING - 242) 23.15

SITE: #1

		SM(1)	SM(2)	SM(3)					AVE			TEMP (C)					
CAPACITY		3.22	12.88	48.30													
JUL	AMT				ET(1)	ET(2)	ET(3)	ETP	ETP	PREC	STR	MAX	MIN	RUNOFF	CRNOFF	CRPDAY	RAD
152	0.83	0.52	11.98	48.30	2.70	0.90	0.0	4.5	4.5	0.0	0.20	23.1	6.9	0.0	0.0	8	293
153	0.91	0.30	10.52	48.30	0.22	1.46	0.0	7.1	5.8	0.0	0.76	28.5	6.9	0.0	0.0	9	480
154	1.12	3.19	9.09	48.30	0.11	1.43	0.0	4.8	5.5	3.0	0.68	20.6	13.1	0.00	0.00	10	113
155	1.15	0.0	6.69	48.30	3.19	2.39	0.0	8.0	6.1	0.0	0.30	22.7	8.9	0.0	0.00	11	303
156	1.17	0.0	5.87	48.30	0.0	0.62	0.0	10.5	7.0	0.0	0.92	25.3	13.5	0.0	0.00	12	458
157	1.20	0.0	5.42	48.30	0.0	0.45	0.0	6.9	7.0	0.0	0.93	25.8	10.5	0.0	0.00	13	315
158	1.22	0.30	5.12	48.30	0.0	0.29	0.0	4.9	6.7	0.3	0.94	21.5	8.2	0.00	0.00	14	229
159	1.24	2.02	4.97	48.30	0.08	0.16	0.0	2.7	6.2	1.8	0.91	14.1	6.9	0.00	0.00	15	144
160	1.26	3.22	6.17	48.30	0.69	0.20	0.0	3.9	5.9	3.5	0.72	16.7	6.6	0.00	0.00	16	289
161	1.28	1.19	5.76	48.30	2.93	0.39	0.0	5.4	5.9	0.9	0.39	21.9	5.9	0.00	0.00	17	310
162	1.30	0.60	5.32	48.30	0.59	0.46	0.0	7.5	6.0	0.0	0.86	26.0	8.0	0.0	0.00	18	407
163	1.32	1.35	4.42	48.30	0.25	0.40	0.0	7.7	6.2	1.0	0.92	26.2	9.1	0.0	0.00	19	277
164	1.35	3.22	6.99	48.30	0.52	0.24	0.0	4.8	6.1	4.7	0.84	19.3	11.3	0.00	0.00	20	282
165	1.37	3.22	7.60	48.30	2.37	0.42	0.0	4.5	5.9	3.6	0.38	21.4	8.9	0.00	0.00	21	181
166	1.43	3.22	9.12	48.30	2.02	0.56	0.0	4.9	5.8	4.5	0.35	20.1	12.4	0.00	0.00	22	272
167	1.47	3.22	9.5[illegible]	48.30	2.39	1.35	0.0	4.5	5.7	4.2	0.17	18.8	7.4	0.00	0.00	23	297
168	1.51	3.22	10.66	48.30	2.52	1.41	0.0	4.7	5.6	5.0	0.17	18.7	7.2	0.00	0.00	24	308
169	1.56	3.22	11.76	48.30	1.59	0.91	0.0	3.1	5.3	3.6	0.19	14.3	9.7	0.00	0.00	25	134
170	1.61	3.22	12.88	48.30	2.50	1.43	0.0	4.8	5.3	13.7	0.16	18.1	9.7	8.55	8.55	26	271
171	1.65	3.22	12.88	48.30	2.24	1.22	0.0	4.2	5.2	6.6	0.18	17.5	8.8	3.14	11.69	27	225
172	1.70	3.22	12.88	48.30	3.22	2.36	0.0	7.4	5.4	5.8	0.25	23.1	9.5	0.22	11.90	28	468
173	1.75	0.50	10.72	48.30	3.22	2.16	0.0	6.9	5.5	0.5	0.22	23.8	10.3	0.00	11.90	29	382
174	1.80	0.67	6.15	48.30	0.23	4.57	0.0	9.9	6.0	0.4	0.51	28.4	10.4	0.00	11.90	30	559
175	1.85	3.22	7.23	48.30	0.32	0.95	0.0	10.2	6.4	4.9	0.88	30.4	12.0	0.00	11.90	31	593
176	1.91	1.90	6.35	48.30	3.22	0.88	0.0	9.4	6.7	1.9	0.56	25.6	12.9	0.00	11.90	32	476
177	1.96	3.22	12.88	48.30	1.90	0.96	0.0	11.4	7.2	15.6	0.75	22.0	10.3	4.90	16.80	33	473
178	2.00	3.22	11.28	46.94	3.22	3.18	1.36	8.7	7.3	4.8	0.11	20.9	8.3	0.00	16.80	34	345
179	2.03	1.60	7.12	45.01	3.22	4.16	1.93	11.2	7.7	1.6	0.17	20.5	8.3	0.00	16.80	35	541
180	2.07	3.22	10.92	43.46	0.77	1.00	1.56	7.5	7.7	7.2	0.56	23.4	9.0	0.00	16.80	36	444
181	2.11	3.22	8.12	42.06	3.22	3.08	1.40	8.7	7.8	3.5	0.11	27.7	8.7	0.00	16.80	37	461
182	2.16	3.22	12.88	48.30	1.85	0.74	0.81	5.0	7.5	20.0	0.32	26.5	13.4	5.59	22.39	38	210
183	2.22	1.18	10.75	47.39	2.44	2.13	0.91	6.3	7.4	0.4	0.13	30.3	15.6	0.00	22.39	39	266
184	2.28	3.22	10.15	46.46	0.33	2.13	0.93	5.0	7.2	3.9	0.32	30.8	18.2	0.00	22.39	40	248
185	2.35	3.22	12.88	48.30	1.97	1.80	0.60	5.2	7.0	17.6	0.12	32.6	17.7	8.46	30.85	41	241
186	2.42	3.20	9.82	46.99	3.22	3.06	1.31	8.4	7.1	3.2	0.10	34.1	17.6	0.00	30.85	42	477
187	2.49	2.60	6.60	45.43	3.20	3.22	1.56	9.1	7.3	2.6	0.12	34.8	17.5	0.00	30.85	43	461
188	2.55	3.22	7.38	44.69	1.04	0.46	0.74	4.2	7.0	3.5	0.32	24.9	18.5	0.00	30.85	44	139
189	2.60	1.58	6.84	43.97	1.64	0.54	0.72	4.4	6.7	0.0	0.34	25.4	14.6	0.0	30.85	45	243
190	2.65	0.94	6.06	42.66	0.64	0.78	1.31	6.3	6.7	0.0	0.57	28.9	15.6	0.0	30.85	46	351
191	2.71	0.59	5.16	40.47	0.35	0.90	2.19	9.2	6.9	0.0	0.63	30.4	14.1	0.0	30.85	47	492
192	2.76	0.38	4.44	38.03	0.21	0.72	2.44	9.8	7.2	0.0	0.66	29.2	13.7	0.0	30.85	48	513
193	2.82	0.23	3.87	35.57	0.15	0.57	2.46	9.7	7.5	0.0	0.67	32.2	13.7	0.0	30.85	49	454
194	2.88	2.31	3.44	33.39	0.11	0.43	2.18	6.5	7.6	2.2	0.68	33.0	14.4	0.00	30.85	50	385
195	2.94	3.20	3.13	32.49	2.31	0.31	0.90	6.8	7.7	3.2	0.60	33.8	16.4	0.00	30.85	51	399
196	3.01	1.90	2.68	31.43	3.20	0.25	1.07	9.1	7.8	1.9	0.50	34.4	17.5	0.00	30.85	52	405
197	3.06	3.22	6.82	30.53	1.12	0.23	0.90	6.8	7.7	6.6	0.67	28.2	15.6	0.00	30.85	53	286
198	3.10	3.22	12.88	32.75	2.23	0.56	0.52	5.3	7.5	11.6	0.37	27.7	13.0	0.00	30.85	54	169
199	3.15	1.60	7.96	31.61	3.22	4.92	1.14	12.3	8.0	1.6	0.25	27.9	12.8	0.00	30.85	55	508
200	3.20	2.60	6.65	30.67	0.90	1.31	0.95	7.7	7.9	1.9	0.59	30.0	13.7	0.00	30.85	56	303
201	3.26	0.0	5.59	29.56	2.60	1.07	1.10	10.7	8.2	0.0	0.55	32.8	13.0	0.0	30.85	57	482
202	3.31	1.40	4.72	28.40	0.0	0.67	1.16	8.7	8.3	1.4	0.77	32.1	14.1	0.00	30.85	58	358
203	3.36	2.88	4.19	27.53	0.72	0.52	0.67	7.9	8.2	2.2	0.73	31.0	15.4	0.00	30.85	59	267
204	3.40	3.22	7.67	27.06	2.22	0.27	0.47	5.2	7.9	6.3	0.43	28.1	12.7	0.00	30.85	60	199

210	342	36	49	272	419	165	118	3810	212
210	342	31	63	255	469	246	112	3845	213
210	342	0	101	378	656	295	126	3889	214
210	342	24	78	216	355	265	139	3931	215
210	342	2	57	146	312	280	125	3971	216
210	342	3	78	270	521	337	137	4021	217
210	342	15	91	374	634	344	146	4143	218
210	342	30	62	166	325	244	151	4256	219
210	342	0	112	421	710	265	123	4352	220
210	342	0	88	473	767	282	84	4424	221
210	342	0	101	467	760	306	105	4514	222
210	342	0	101	455	734	299	119	4614	223
210	342	0	64	304	452	246	127	4713	224
210	342	0	67	313	499	267	117	4806	225
210	342	27	45	194	249	219	120	4899	226
210	342	7	75	412	596	263	84	4973	227
210	342	15	47	171	251	198	103	-1000	228
210	342	7	45	189	258	227	113	-1000	229
210	342	51	52	317	457	223	124	-1000	230
210	342	99	43	259	377	224	126	-1000	231
210	342	63	49	235	347	242	142	-1000	232
210	342	0	87	433	652	267	124	-1000	233
210	342	118	101	407	539	277	163	-1000	234
210	342	14	66	164	265	254	132	-1000	235
210	342	132	45	115	116	171	93	-1000	236
210	342	66	57	309	407	194	74	-1000	237
210	342	0	61	367	545	248	77	-1000	238
210	342	0	81	400	614	319	116	-1000	239
210	342	0	101	442	653	314	130	-1000	240
210	342	0	94	449	642	244	101	-1000	241
210	342	0	90	435	621	253	90	-1000	242

210 342 1 151 0.70 12.88 51.52 0.0 12.88 51.52 0.0 0.0 0.0 0.0

0.0 0.0 0.0 0.0 0.0 0.0 0.0 2.10 0.0 0.0 0.0 0.0

47.40-108.54 145 27 7 0 0 0 0 7 0 1 4 31 0 1

7.0 DATA BASES

Three types of data bases are generated during the AGMET construction and execution. Type one consists of permanent files. The following data bases are of this type:

1. Meteorologic historic
2. Agronomic historic
3. Agronomic Season File

Type two data bases are old master, new master files which are generated continuously by program execution. The following data bases are of this type:

1. Meteorologic daily
2. Agronomic archive
3. Agronomic class day

Type three data bases are master copies of the total season results from meteorologic and agronomic models. These data bases are:

1. The meteorologic season master
2. The agronomic season master

With the notable exception of the meteorologic historic, the records are read and written from common blocks or vectors in binary strings using assembler input-output routines. Section documentation for each data base will describe record and file structure and the FORTRAN buffer area, common block or array and briefly describe each variable.

7.1 Type I Data Bases (Permanent Files)

These data bases are initially created for a particular growing season, and once created are used in a read only manner.

7.1.1 Meteorologic Historic

This file is created by the program STAIJ and METGEN prior to season growth. It contains historical meteorological information necessary to application to station data.

7.1.1.1 File Structure

This file is ordered as follows:

1. Ascending I
2. Ascending J within each I

and is normally processed sequentially from beginning to end.

7.1.1.2 Record Structure

Each record contains 16 scaled variables in FORTRAN format (2I3, 14I5). Table 7-1 gives variable descriptions, location, type, and scale factor for each data record.

SYMBOLIC NAME	LOCATION (Bytes)	TYPE	SCALE FACTOR	DESCRIPTION
IX	1-3	CS	1	I Location
JX	4-6	CS	1	J Location
ISTAS(1,I,J)	7-11	CS	1	Number of closest station to I, J
IR(1,I,J)	12-16	CS	1,000	Weather weight of station N
	17-21	CS	1	N_2 2nd closest station
	22-26	CS	1,000	Weight of station N_2
∘	27-31	CS	1	N_3 3rd closest station
∘	32-36	CS	1,000	Weight of station N_3
∘	37-41	CS	1	N_4 4th closest station
	42-46	CS	1,000	Weight of station N_4
	47-51	CS	1	N_5 5th closest station
	52-56	CS	1,000	Weight of station N_5
ISTAS(6,I,J)	57-61	CS	1	N_6 6th closest station
IR(6,I,J)	62-66	CS	1,000	Weight of station N_6
PLNDAT(I,J)	67-71	CS	1	Planting date
IBMT(I,J)	72-76	CS	1,000	Bimeterological time

CS = Character String

BI = Binary String

TABLE 7-1

Meteorological Historic Record Structure

7.1.2 Agronomic Historic File

This file created by the programs HISTGEN, HISTAD, HISTUP, contains the historic agronomic data for each I, J.

7.1.2.1 File Structure

This file is an ordered file but can be processed randomly by key. It is ordered as follows:

1. Ascending I
2. Ascending J within each I
3. Ascending K within each J

The key associated with each record is KEY = (I - 1)*28*4 + (J - 1)* 4 + K and I = I - 208, J = J - 335.

7.1.2.2 Record Structure

Each record is a binary string of 13 variables and is transferred from and to a common block HIST for formatting purposes. Descriptions of record structure are in Table 7-2.

SYMBOLIC NAME	LOCATION (Bytes)	TYPE	SCALE FACTOR	DESCRIPTION
II	1-4	BI-INTEGER*4		I Location
JJ	5-8	BI-INTEGER*4		J Location
KK	9-12	BI-INTEGER*4		K Location
LAT	13-16	BI-REAL*4		I, J, K Latitude
LON	17-20	BI-REAL*4		I, J, K Longitude
YLDTND	21-24	BI-REAL*4		- unused - trend value
YLDADF	25-28	BI-REAL*4		- unused -
STATE	29-30	BI-INTEGER*2		I, J, K state location
COUNTY	31-32	BI-INTEGER*2		I, J, K county location
CRD	33-34	BI-INTEGER*2		I, J, K crop reporting district location
SOIL	35-36	BI-INTEGER*2		I, J, K soil assignment
PLNDAT	37-38	BI-INTEGER*2		I, J, K planting date
TSTSIT	39-40	BI-INTEGER*2		- unused - test site indicator

CS = Character String

BI = Binary String

FIGURE 7-2

Historic Agronomic File

7.1.3 Agronomic Site Season

This file created by the programs INITIAL contain site season initialization constants.

7.1.3.1 File Structure

This file is ordered for sequential processing and the order is:

1. Ascending I
2. Ascending J within each I
3. Ascending K within each J

7.1.3.2 Record Structure

Each record contains 13 variables in a binary string and formatted internally through the common block archive. The description of the record structure is contained in Table 7-3.

SYMBOLIC NAME	LOCATION (Bytes)	TYPE	DESCRIPTION
I	1-4	INTEGER*4	I grid location
J	5-8	INTEGER*4	J grid location
K	9-12	INTEGER*4	K grid location
JUL	13-16	INTEGER*4	Julian date
BMT	17-20	REAL*4	Bimeteorological time
SM(1)	21-24	REAL*4	Soil moisture capacity top layer
SM(2)	25-28	REAL*4	Soil moisture capacity middle layer
SM(3)	29-32	REAL*4	Soil moisture capacity bottom layer
ET(1)	33-36	REAL*4	Evapotranspiration top soil layer
ET(2)	37-40	REAL*4	Evapotranspiration middle soil layer
ET(3)	41-44	REAL*4	Evapotranspiration bottom soil layer
ETP	45-48	REAL*4	Potential evapotranspiration
ETPAVE	49-52	REAL*4	Running average evapotranspiration
PRECIP	53-56	REAL*4	Precipitation for Julian date
STRESS	57-60	REAL*4	Daily stress
TMAX	61-64	REAL*4	Maximum temperature
TMIN	65-68	REAL*4	Minimum temperature
CRNOFF	69-72	REAL*4	Cumulative runoff
STRINT(1)	73-76	REAL*4	Total stress in BMT interval 0-1
STRINT(2)	77-80	REAL*4	Total stress in BMT interval 1-2
STRINT(3)	81-84	REAL*4	Total stress in BMT interval 2-3
STRINT(4)	85-88	REAL*4	Total stress in BMT interval 3-4
STRINT(5)	89-92	REAL*4	Total stress in BMT interval 4-5
NDAY(1)	93-94	INTEGER*2	Number of days in BMT interval 0-1
NDAY(2)	95-96	INTEGER*2	Number of days in BMT interval 1-2
NDAY(3)	97-98	INTEGER*2	Number of days in BMT interval 2-3

NDAY(4)	99-100	INTEGER*2	Number of days in BMT interval 3-4
NDAY(5)	101-102	INTEGER*2	Number of days in BMT interval 4-5
LRPDAY	103-104	INTEGER*2	Number of crop growth days
TSOIL	105-106	INTEGER*2	Soil category
RAD	107-108	INTEGER*2	Net radiation

TABLE 7-3

Agronomic Site Season

SYMBOLIC NAME	LOCATION (Bytes)	TYPE	SCALE FACTOR	DESCRIPTION
ARRAY(1)	1-2	INTEGER*2	1	I location
ARRAY(2)	3-4	INTEGER*2	1	J location
ARRAY(3)	5-6	INTEGER*2		Total daily precipitation
ARRAY(4)	7-8	INTEGER*2	10	Potential evapotranspiration
ARRAY(5)	9-10	INTEGER*2	1	Net radiation
ARRAY(6)	11-12	INTEGER*2	1	Solar radiation
ARRAY(7)	13-14	INTEGER*2	10	Maximum temperature
ARRAY(8)	15-16	INTEGER*2	10	Minimum temperature
ARRAY(9)	17-18	INTEGER*2	1,000	BMT
ARRAY(10)	19-20	INTEGER*2	1	Julian date

TABLE 7-4b

ARRAY(1)	1-2	INTEGER*2	1	Year
ARRAY(2)	3-4	INTEGER*2	1	Day
ARRAY	4-6		1	24
ARRAY(3)			1	
ARRAY(4)			1	
ARRAY(5)			1	
ARRAY(6)	7-18		1	- Filler -
ARRAY(7)			1	
ARRAY(8)			1	
ARRAY(9)			1	
ARRAY(10)	19-20		1	Dummy parameter for sort (999)

TABLE 7-4a

7.2 Type-II Data Bases (Old Master-New Master)

These data bases serve two purposes. They initialize model growth for this cycle from results of the previous growth. They provide storage mechanism for each cycle's data.

7.2.1 Meteorological Daily

This file stores the meteorological daily results on a daily basis. This data is recorded for input to the agronomic model and is used to define the characteristic daily plant environment.

7.2.1.1 File Structure

This file's last day is processed by the MET model to extract last day BMT for use in the initialization of the present cycle. It is ordered by:

1. Julian date
2. I location within each day
3. J location within each I

7.2.1.2 Record Structure

Each record is a binary string formatted using an array address as the start buffer location. Records are formatted as indicated in Table 7.4. Two record types are present and occur in the following frequency for each data:

1. Daily header record with Julian date
2. 756 meteorological daily records one per I, J

7.2.2 Agronomic Archive

This file contains the results of the present cycle of plant growth on a daily basis and a sorted copy of the total season archive

results constitutes the agronomic season master. Any single day's results can be input to the PREDRUN program for yield prediction.

7.2.2.1 File Structure

Each archive tape is an ordered file as follows:

1. I location
2. J location within each I
3. K location within each J
4. Julian date within each I, J, K.

Cells not within the study area are assigned I = -1, J = -1, K = -1, Julian date = -1 but are placed in their relative location within the file.

7.2.2.2 Record Structure

The agronomic archive record structure is a duplicate (Table 7-3) of the agronomic season record.

7.2.3 Agronomic Last Day File

This file contains the final status of each study area cell and serves to initialize the agronomic model when growth is continued.

7.2.3.1 File Structure

Each last day file contains one day's data sorted as follows:

1. I location
2. J location within each I
3. K location within each J.

Cells outside the study area are assigned I = -1, J = -1, K = -1, Julian date = -1 but are in their relative location within the file.

7.2.3.2 Records Structure

The appropriate record structure is described in Table 7-3.

7.3 Type-III Data Basis

Master copies of the total season results are generated using the IBM system utility IEBGENER copying each cycle's results using the MOD disposition. These data bases contain the total results of the agronomic and meteorological models and provide a mechanism for analyzing the models.

7.3.1 Meteorologic Season Master

7.3.1.1 File Structure

The total season results from the meteorologic model are ordered as in section 7.2.1.1 with N repititions where N is the number of cycles run. This file is also created using the IBM system utility IEBGENER with the MOD disposition, to copy each cycle's results.

7.3.1.2 Record Structure

Record structure is identical to description in Section 7.2.1.2.

7.3.2 Agronomic Season Master

7.3.2.1 File Structure

This file is structured using the IBM supplied system sorting routines and is ordered as follows:

1. I
2. J within each I
3. K within each J
4. Julian date

7.3.2.2 Record Structure

Record structure is described in Table 7-3.

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